CLIPSTER

DCI Mastering

Supplement User Guide

Supplement User Guide: CLIPSTER DCI Mastering
Document Version 2.0 for the CLIPSTER Software Version 3.1

Copyright © 2008-2010 by DVS Digital Video Systems AG, Hanover. All rights reserved.

The manuals as well as the soft- and/or hardware described here and all their constituent parts are protected by copyright. Without the express permission of DVS Digital Video Systems AG any form of use which goes beyond the narrow bounds prescribed by copyright legislation is prohibited and liable to prosecution.

This particularly applies to duplication, copying, translation, processing, evaluation, publishing, and storing and/or processing in an electronic system.

Specifications and data may change without notice. We offer no guarantee that this documentation is correct and/or complete. In no event shall DVS Digital Video Systems AG be liable for any damages whatsoever (including without limitation any special, indirect or consequential damages, and damages resulting from loss of use, data or profits, or business interruption) arising out of the use of or inability to use the hardware, software and/or manual materials.

Those parts of this documentation that describe optional software or hardware features usually contain a corresponding note. Anyway, a lack of this note does not mean any commitment from DVS Digital Video Systems AG.

CLIPSTER and DVS are registered trademarks of DVS Digital Video Systems AG.

Any other product names mentioned in this documentation may be trademarks or registered trademarks of their respective owners and as such are subject to the usual statutory provisions.

CLIPSTER DCI Mastering Supplement User Guide

Introduction

Getting Started

Digital Cinema Delivery Tool

Using the DCP and Self KDM

Stereoscopic DCP

Creating a DCP Manually

Miscellaneous

Index

Headquarters:

DVS Digital Video Systems AG
Krepenstr. 8
30165 Hannover
GERMANY

Phone:	+49-511-67807-0
Fax:	+49-511-630070
E-mail:	info@dvs.de
Internet:	http://www.dvs.de

Support:

Phone:	+49-511-67807-125
Fax:	+49-511-371985
E-mail:	support@dvs.de

For the Americas:

U.S. Headquarters:

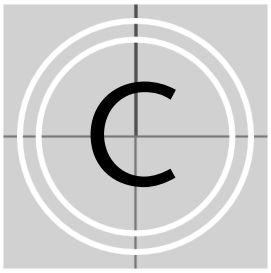
DVS Digital Video, Inc.
300 East Magnolia Boulevard, Suite 102
Burbank, CA 91502
USA

Phone:	+1-818-846-3600
Fax:	+1-818-846-3648
E-mail:	info@dvsus.com
Internet:	http://www.dvsus.com

Support:

E-mail:	support@dvsus.com

Contents



1 Introduction 1-1

1.1 Overview 1-2
1.2 Target Group 1-3
1.3 Conventions Used in this User Guide 1-4
1.4 Abbreviations 1-5
1.5 General Notes 1-5

2 Getting Started 2-1

2.1 Basics 2-2
2.1.1 The DCI Mastering Steps 2-2
2.1.2 Possible Formats for a DCI Mastering 2-4
2.1.3 DCP Standards 2-6
2.2 Preparing the Source Data 2-7
2.2.1 The Steps to Prepare a DSM 2-7
2.2.2 The Steps to Prepare a DCDM 2-7
2.2.3 The Steps to Prepare JPEG2000 Data 2-9
2.3 Setting Reels 2-10
2.3.1 Setting Reels Automatically 2-10
2.3.2 Setting Reels Manually 2-12
2.3.3 Editing and Configuring the Reels 2-13
2.4 Configuring the System for a DCP Creation 2-17
2.5 How to Start a DCI Mastering 2-20

3 Digital Cinema Delivery Tool 3-1

3.1 Starting the Digital Cinema Delivery Tool 3-2
3.2 Overview 3-3

3.3 The Configuration Steps 3-5
3.3.1 Delivery Type 3-5
3.3.2 Source Type 3-9
3.3.3 Delivery Format 3-11
3.3.4 JPEG2000 3-13
3.3.5 CPL 3-15
3.3.6 KDM 3-17
3.3.7 Delivery Creation 3-19
3.4 The Generated Files 3-21

4 Using the DCP and Self KDM 4-1

4.1 Configurations for a Self KDM 4-2
4.2 Loading the DCP 4-3
4.3 The Menu Option 'Load KDM...' 4-5
4.4 Creating Additional KDMs (KDM only) 4-6
4.5 Modifying a DCP (Supplemental DCP) 4-7
4.5.1 Preparations 4-7
4.5.2 The Configuration Steps 4-8
4.5.3 Reel Settings 4-8
4.5.4 Delivery Creation 4-10

5 Stereoscopic DCP 5-1

5.1 Types of 3D Material 5-2
5.2 Preparing the Edit Tool for 3D 5-3
5.2.1 Preparing Two Separate Clips as 3D Material 5-3
5.2.2 Preparing Interleaved 3D Material 5-4
5.3 Working with 3D Material 5-7
5.3.1 Merging and Unmerging Video Tracks 5-7
5.3.2 Particulars about Merging and Unmerging 5-8
5.3.3 Editing 5-10
5.3.4 Viewing and Playing Out 5-10
5.4 Generating 3D Material 5-14
5.4.1 Creating a 3D DCP 5-14
5.4.2 Finalizing 3D Material 5-15
5.4.3 Recording 3D Material 5-16

6 Manual Creation of a DCP 6-1

6.1 Creating a DCDM Manually 6-2
6.2 Creating JPEG2000 D-Cinema Data Manually 6-4
6.3 Creating a DCP Manually 6-6
6.3.1 Finalize Settings – Naming and Storage Options 6-6
6.3.2 Finalize Settings – File and Video Format 6-6
6.3.3 Finalize Settings – CPL 6-8
6.3.4 Finalize Settings – KDM 6-9
6.3.5 Further Finalize Settings and Rendering 6-10
6.4 Creating Additional KDMs Manually 6-11
6.5 Modifying a DCP Manually 6-12

7 Miscellaneous 7-1

7.1 Color Space Conversions 7-2
7.2 Adapting the Rating Agencies 7-4
7.3 Keyboard Shortcuts 7-5
7.4 JPEG2000 Options 7-6
7.5 Keys and Certificates Explained 7-8
7.5.1 What's a Key 7-8
7.5.2 What's a Certificate 7-8
7.5.3 The Key Players of the DCI Mastering 7-9
7.5.4 The Keys Applied 7-11
7.5.5 What's a Certificate Chain 7-13
7.5.6 Validating Certificates 7-15
7.5.7 The Keys and Certificates Delivered with CLIPSTER 7-16

I Index I-1

Introduction

This document describes the optionally available DCI Mastering feature of CLIPSTER and the steps that are required to create a DCP successfully.

The CLIPSTER DCI Mastering feature allows you to create digital content which adheres to the standards formulated by the Society of Motion Picture and Television Engineers (SMPTE), and thus widely the specifications as originally formulated by Digital Cinema Initiatives (DCI). With it you will be able to take the D-Cinema steps from DSM to DCP over CPL and KDM with ease.

With the CLIPSTER DCI Mastering feature you can generate a Digital Cinema Package (DCP) from a Digital Source Master (DSM) directly in one step. However, all intermediate steps, such as a Digital Cinema Distribution Master (DCDM) or JPEG2000 encoded files, can be generated as well. For all this the DVS software provides the comprehensive digital cinema delivery tool which will lead you through the different configurations step by step.

Truly beneficial is the possibility to load and adapt an already created DCP. With this you cannot only quality check the final result or create additional KDMs, for example, for future releases, but you can create different versions of a DCP, for instance, for localizations of a feature film. Additionally, you will be able to handle 3D material in the timeline and thus to create stereoscopic digital cinema content.

Any renderings which may be necessary during the creation of an intermediate result or the final DCP will be supported by additional hardware (such as the CLIPSTER JPEG2000 accelerator board), enabling you, for example, to generate JPEG2000 encoded 12-bit X'Y'Z' files in near or even faster than real time.

1.1 Overview

This user guide describes the possibilities and user interface items of the DCI Mastering feature of CLIPSTER as well as the steps required to create digital cinema content.

The chapters in this user guide contain the following information:

Chapter 1	Begins with a short introduction to the DCI Mastering feature, followed by a note regarding the audience this manual is written for and an explanation of the conventions used in this manual. Additionally, it details the abbreviations used and some general notes that you should observe.
Chapter 2	Contains basic information about a DCI Mastering. Here you can find, for example, information about the phases that a final DCP consists of or the basic configurations that are required for the DVS system. Furthermore, this chapter describes how to handle and prepare the source data to be converted to digital cinema content.
Chapter 3	Describes the digital cinema delivery tool which will lead you through the different steps to create digital cinema content.
Chapter 4	Explains how to use a DCP and the self KDM after their creation, for example, to quality check the final result, to add KDMs or to generate different versions of a DCP.
Chapter 5	Describes the 3D features of the DVS software. Among others it is explained how to create a stereoscopic DCP.
Chapter 6	Describes the steps how to manually create the final DCP or an intermediate result with the DVS software via finalizing.
Chapter 7	Provides further details and information that may be useful for a DCI Mastering.
Index	This chapter facilitates the search for specific terms.

1.2 Target Group

To use this manual and the DCI Mastering feature effectively you should be familiar with the DVS soft- and hardware as well as the manuals delivered with the DVS system. Furthermore, to create content for digital cinemas you should have knowledge about the digital cinema environments where it will be used as well as about the expected form/structure of the content (because a few may deviate from the SMPTE standards and/or the specifications of DCI).

Additionally, it would be beneficial to be familiar with the SMPTE standards concerned with the creation of digital cinema content and the specifications of DCI.

1.3 Conventions Used in this User Guide

The following typographical conventions will be used in this documentation:

- Texts preceded by this symbol describe activities that you must perform in the order indicated.

– Texts preceded by this symbol are parts of a list.

Texts preceded by this symbol are general notes intended to facilitate work and help avoid errors.

You must pay particular attention to text that follows this symbol to avoid errors.

“ ” Texts enclosed by quotation marks are references to other manuals, guides, chapters, or sections.

’Window’	Text in bold with single quotation marks indicates a window name
BUTTON	Text in small caps and bold indicates push buttons
Group/Menu	Text in italic and bold indicates either a group name, menu name or options in a menu list
Menu » Option	In the specified group or menu select the stated item
Item	Text in bold only stands for other labeled items of a user interface
`Directory/File`	Directory structure or file
`Entry`	Parameters, selections or entries made in the program; it may also indicate a file syntax or contents of a file
[Key]	An individual key or a key combination on a keyboard

Keyboard Shortcuts

To perform options or procedures with the keyboard often requires a simultaneous pressing of two keys.

Example:

[Ctrl + F1]	If this is given, hold down the [Ctrl] key and press simultaneously the [F1] key.

1.4 Abbreviations

The following lists the abbreviations used in this document. Most are from the SMPTE standards and/or the specifications of DCI.

Abbreviation	Shortened Form of
CPL	Composition Playlist
DCDM	Digital Cinema Distribution Master
DCI	Digital Cinema Initiatives, LLC
DCP	Digital Cinema Package
DSM	Digital Source Master
KDM	Key Delivery Message
PKL	Packing List
SMPTE	Society of Motion Picture and Television Engineers

1.5 General Notes

In the following you can find some general notes that may be helpful for your work with the DCI Mastering feature or this user guide:

The DCI Mastering is available as an optional feature. Upgrades from previous CLIPSTER versions may be possible but depend on the system hardware delivered to you.

For further details about user interface items not described in this document please refer to the other user guides delivered with the DVS system.

Getting Started

This chapter provides basic information about a DCI Mastering and describes the preliminary steps to start one. Here you can find, for example, information about the phases that a final DCP creation comprises or the basic configurations that are required for the DVS system. Additionally, it will be described how to deal with the source data and prepare it to be converted to digital cinema content.

2.1 Basics

This section provides some basic information for a DCI Mastering. First the general steps and phases that a DCP consists of will be described as they are outlined by DCI. Among them you can find some recommendations and useful notes for a DCI Mastering with CLIPSTER. Afterwards details about some of the allowed video and audio formats for digital cinema content are provided because a DCP has to be created in one of the defined formats only. This is followed by information about the different standards for a DCP packaging that have been in use and can be applied with the DVS system.

2.1.1 The DCI Mastering Steps

The generation of a Digital Cinema Package (DCP) consists of various steps and phases that can be easily accomplished with the DCI Mastering feature of CLIPSTER. These were outlined by DCI and with CLIPSTER you are totally free in your decision whether to make one of the intermediate steps towards a DCP, to finish an intermediate state to a DCP or to create a DCP in a single step. The individual steps that a DCP is composed of are explained shortly in the following.

Figure 2-1: The DCP steps

Digital Source Master (DSM)

The first step to create a SMPTE/DCI compliant Distribution Package for digital cinemas is the Digital Source Master (DSM). With CLIPSTER this step would be the same as with most projects: You simply have to assemble your project in the timeline of the Edit Tool and edit it as desired with, for example, trimmings, transitions, color corrections, etc.

The SMPTE as well as DCI clearly state that the Digital Source Master (DSM) itself is not defined, i.e. it 'may consist of any color space, pixel matrix (spatial), frame rate (temporal), bit depth and many other metrics' (SMPTE 428-1). Therefore, it lies totally in your own discretion how to prepare a project and thus the DSM. It is this 'master project' that can then be converted to different formats for various applications, such as a Digital Cinema Distribution Master (DCDM), a home video master, a broadcast master, or a master for archiving purposes.

For best results DVS recommends that the timeline of a DSM in the Edit Tool consists of clips in the RGB color space only and that it is set to a digital cinema compliant frame rate.

Digital Cinema Distribution Master (DCDM)

The Digital Cinema Distribution Master (DCDM) as the next phase for a DCP is deemed the exchange format by DCI for environments involved in the task to create D-Cinema content. It can be used as a complete and standardized format to communicate movies, for instance, between studio and post production.

To serve as a master and exchange format the DCDM should be saved in very high quality (i.e. in 16-bit X'Y'Z' in the TIFF file format) with the resolution, frame rate and audio channel distribution of the later DCP (see also section "Possible Formats for a DCI Mastering" on page 2-4).

It is one of CLIPSTER's advantages that an explicit creation of a DCDM is not mandatory. With CLIPSTER a DCP can be made from a DSM directly and you do not have to make a DCDM first in order to get a DCP. Nevertheless, in case a DCDM is required, it can be generated with CLIPSTER easily.

DCI suggested to store the DCDM in 12 bit padded to 16 bit that the SMPTE in their standards reduced to 12 bit altogether. For best results CLIPSTER will store the data in true 16 bit when creating a DCDM, meaning when the DSM is in 16 bit already, it will be stored in the DCDM in 16 bit as well and not rounded down to 12 bit.

JPEG2000

For the sake of storage space and bandwidth the size of a DCP must be reduced so that it can be transported, saved and displayed without great efforts. For this the image files of the DCP will be converted to 12 bit (X'Y'Z') and then encoded with JPEG2000 (lossy compression). For maximum efficiency CLIPSTER encodes the image data with a variable bit rate (VBR). The audio data will not be compressed.

Same as with the DCDM, with CLIPSTER you do not have to create the JPEG2000 material explicitly to get a DCP. A DCP can be created from a DSM directly which will include the JPEG2000 compression automatically. However, if only the JPEG2000 encoded data is required, it can be created with CLIPSTER without difficulty.

The DCI specification limits the data rate for a successful presentation in a digital cinema theater to a file size of 1.302083 MB per 2K image at 24 frames per second, equivalent to a sustained data rate of 250 Mbit/sec. For a frame rate of 48 fps, a 2K distribution should be set to a maximum of 651,041 bytes per frame (also 250 Mbit/sec.).

In CLIPSTER the settings of a JPEG2000 encoding are configured by default to this maximum data rate specified by DCI, i.e. to the highest quality allowed for a DCP.

Digital Cinema Package (DCP)

During the last stage of a DCP creation, the audio and JPEG2000 encoded image files will be wrapped (either encrypted or unencrypted) in the MXF format as the DCP's content delivery format.

This last phase in the creation of the final Digital Cinema Package (DCP) performs various steps itself: It will split the video/audio data into reels, encrypt the data (if wanted), wrap the audio and video reels separately in the MXF format, and generate the extra files for a DCP, such as the Composition Playlist (CPL), Key Delivery Message (KDM), Packing List (PKL), etc. (see section "The Generated Files" on page 3-21). With this you will get a D-Cinema compliant output that can then be sent to the theaters for which it has been created (if encrypted).

All this and the steps mentioned before (DCDM and JPEG2000) can be created with CLIPSTER from a DSM in a single step. But, of course, any intermediate step towards a DCP can also be converted to a DCP with the DVS software easily.

For this you have to prepare your source material appropriately prior to the creation by determining reels and configuring the key for CLIPSTER. This is in detail described in the following sections of this chapter.

2.1.2 Possible Formats for a DCI Mastering

This section describes some formats for audio and video that are suitable for a DCP. They were taken from the respective SMPTE specifications. While the video formats listed here can be considered complete, the audio channel mapping described below is only an example. In the SMPTE 428-3 you can find further mappings.

Please note that the formats for video and audio detailed in the following must be applied to a DCDM and JPEG2000 encoding (if created separately) as well as to the final DCP (see also section "The DCI Mastering Steps" on page 2-2). For best results the DSM should have been created in the format of the final DCP already.

Video Formats

The following lists the video formats that are suitable for a DCP:

No. of Active Horizontal Pixels	No. of Active Vertical Pixels	Aspect Ratio	Pixel Aspect Ratio	Frame Rate
4096	2160	1.90:1 (full)	1:1	24
4096	1716	2.39:1 (scope)	1:1	24
3996	2160	1.85:1 (flat)	1:1	24
2048	1080	1.90:1 (full)	1:1	24/48
2048	858	2.39:1 (scope)	1:1	24/48
1998	1080	1.85:1 (flat)	1:1	24/48

If your source material is in a different aspect ratio than the ones detailed above, the material should be scaled for the digital cinema output so that it fits either vertically or horizontally in one of the 'full' formats (thereby applying either letter- or pillarboxing).

Audio Formats and Mapping

Audio should be saved in 24 bit at 48,000 Hz and the DCI specification suggests the WAV file format. For a DCI Mastering the routing of the audio tracks containing the audio data must be adapted as outlined in SMPTE 428-3 in the CLIPSTER Edit Tool. The table below shows mapping and labels suitable for audio in a DCP (quoted from the specification for nine channels):

AES Pair / Ch.	Channel	Label / Name	Description
1/1	1	L/Left	Far left screen loudspeaker
1/2	2	R/Right	Far right screen loudspeaker
2/1	3	C/Center	Center screen loudspeaker
2/2	4	LFE/Screen	Screen low frequency effects subwoofer loudspeakers
3/1	5	Ls/Left surround	Left wall surround loudspeakers
3/2	6	Rs/Right surround	Right wall surround loudspeakers
4/1	7	Lc/Left center	Mid-left to center screen loudspeaker
4/2	8	Rc/Right center	Mid-right to center screen loudspeaker
5/1	9	Cs/Center surround	Rear wall surround loudspeakers
5/2	10		SMPTE reserved

AES Pair / Ch.	Channel	Label / Name	Description
6/1	11		SMPTE reserved
6/2	12		SMPTE reserved
7/1	13		SMPTE reserved
7/2	14		SMPTE reserved
8/1	15		User defined
8/2	16		User defined

Other audio channel mappings can be found in SMPTE 428-3.

2.1.3 DCP Standards

Until today, there have been three different DCP standards in use:

MPEG Interop	Also called 'MXF Interop'. This standard was originally defined by the MPEG Interop Group and is based on MPEG compressed files wrapped in MXF containers.
JPEG Interop	A transitional standard that is identical to the MPEG Interop standard but applies a JPEG2000 compression as proposed by DCI.
SMPTE Phase 1	This standard is based on JPEG Interop but uses different KDMs.

To create a DCP that can be viewed in a digital cinema theater you should know which of the different standards/phases to apply to your DCP creation. With the DCI Mastering feature you can create DCPs in all standards:

– MPEG Interop can be created via a manual finalizing (see chapter "Manual Creation of a DCP" on page 6-1). For this the setting **SMPTE Phase 1** (see section "Configuring the System for a DCP Creation" on page 2-17) has to be deactivated.
– JPEG Interop and SMPTE Phase 1 can be created with the digital cinema delivery tool as well as via a manual finalizing. You can choose between them with the configuration setting **SMPTE Phase 1** (see section "Configuring the System for a DCP Creation" on page 2-17).

2.2 Preparing the Source Data

In order to create a DCP or one of its intermediate steps the available source data has to be prepared. Depending on the step from which to create the digital cinema content (see section "The DCI Mastering Steps" on page 2-2) the source data has to be prepared differently.

When creating a delivery type other than a DCDM, all preprocessing steps, such as scalings or color corrections will be performed as well. For particulars about the creation of a DCDM see section "Digital Cinema Distribution Master (DCDM)" on page 2-3 and section "Color Space Conversions" on page 7-2.

2.2.1 The Steps to Prepare a DSM

To create, for example, a DCP from the original DSM you have to perform the following:

- If not already the case load the project that contains the DSM (video as well as audio) in the timeline.

  It is recommended that the DSM consists of video clips in the RGB color space only and that the timeline is set to a D-Cinema compliant frame rate. Additionally, the routing of the audio tracks containing audio data should be configured to the final routing of the DCP. See also section "Possible Formats for a DCI Mastering" on page 2-4.

Once the DSM is available in the timeline, you can continue the preparation as described later in this chapter (see section "Setting Reels" on page 2-10).

2.2.2 The Steps to Prepare a DCDM

A DCDM is normally saved in X'Y'Z' in the TIFF file format. However, TIFF natively does not store the X'Y'Z' color space, it saves the RGB or Luma color space only. To use a DCDM for the creation of a DCP nevertheless, it must be properly prepared and available in the timeline of the Edit Tool:

- Open a new project in the Edit Tool.
- With the button **SETTINGS...** of the timeline area configure the timeline output settings so that they match the format of the DCDM (normally the same as the final DCP format).
- Add the DCDM clips (video as well as audio) to the bin, for example, by dragging them to the contents area of the bin from a file manager or by using the menu option ***Add clip*** of the bin's context menu.

Afterwards the DCDM clips will be visible in the contents area of the bin. However, because the software registers the added video clip(s) as RGB clips (as stated in the image files' headers), you have to change the color space of the added clip(s) manually:

- Open the properties of the video clip(s) of the DCDM in the bin (context menu of bin clip ***» Properties…***).

  The properties of several clips can be changed in a single step by selecting the clips in the bin and then opening their properties.

Then the properties window of the bin clip(s) will be displayed on the screen.

- In this window set the color space settings to X'Y'Z' (`XYZ`) and confirm your alteration with the **OK** button.

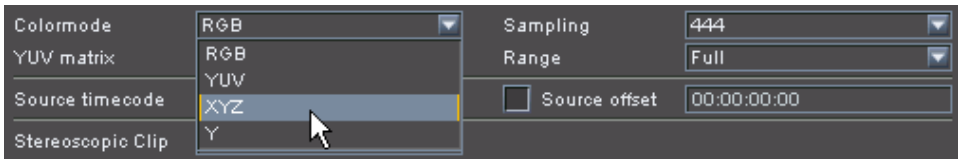


Figure 2-2: Altering the color space settings of the DCDM video clip

Once X'Y'Z' has been selected as the color space, the color matrix setting (**YUV matrix**) will switch to the correct color matrix automatically. With this setting made, an automatic color space conversion from RGB to X'Y'Z' will be prevented during the creation of the DCP.

If your material is in YCxCz (i.e. it was processed with a YUV matrix beforehand), the color space setting must be set to `YUV`. Additionally, the appropriate YUV matrix that was used for the material during processing must be set manually (setting **YUV matrix**).

- Next, add the video clip(s) of the DCDM to the video track(s) of the timeline.
- Add the audio clip(s) of the DCDM to the audio tracks of the timeline.
- If necessary adapt the routing of the audio tracks that now contain audio data so that they are suited for the DCP to be created (see section "Possible Formats for a DCI Mastering" on page 2-4).

With this the DCDM clips are added to the timeline of the Edit Tool and they will be used for the creation of the digital cinema content. You may now continue the preparation as described later in this chapter (see section "Setting Reels" on page 2-10).

2.2.3 The Steps to Prepare JPEG2000 Data

JPEG2000 data that is already adapted for digital cinema will normally be in the format of the final DCP in 12 bit X'Y'Z'. In so far it resembles a DCDM and thus the steps to use such data for the creation of a DCP are almost the same:

- Open a new project in the Edit Tool.
- With the button **SETTINGS...** of the timeline area configure the timeline output settings so that they match the format of the JPEG2000 data (normally the same as the final DCP format).
- Add the required clips (video as well as audio) to the bin, for example, by dragging them to the contents area of the bin from a file manager or by using the menu option ***Add clip*** of the bin's context menu.

Afterwards the clips will be visible in the contents area of the bin and they will be automatically set to the correct color space.

- Next, add the JPEG2000 clip(s) to the video track(s) of the timeline.
- Add the audio clip(s) to the audio tracks of the timeline.
- If necessary adapt the routing of the audio tracks that now contain audio data so that they are suited for the DCP to be created (see section "Possible Formats for a DCI Mastering" on page 2-4).

With this the clips have been added to the timeline of the Edit Tool and they will be used for the creation of the DCP. You may now continue the preparation as described later in this chapter (see section "Setting Reels" on page 2-10).

2.3 Setting Reels

To split the loaded or created project (see section "Preparing the Source Data" on page 2-7) during the creation of the DCP into reels to comply with the requirements of a DCP, you have to define the reels in the timeline: When wrapping to MXF (see section "The DCI Mastering Steps" on page 2-2), the finalized files will be automatically divided at the reel edit points in the timeline, resulting each in one MXF file per output format (video and audio).

The setting of DC reels is not required in case you want to create an intermediate step towards a DCP. DC reels are evaluated during the generation of a DCP only.

In CLIPSTER the DC reels can be set wherever and to whatever length you want. For example, it is not necessary to set them to the edit points of clips in the timeline.

According to DCI it is common practice to divide a feature film into reels of a length between 10 and 20 minutes. According to SMPTE a reel must have a duration of at least one second.

Some digital cinema players may be unable to display reels that are shorter than 5 seconds.

For the viewing and manual editing of DC reels in the timeline the Edit Tool provides a special mode. It can be activated with the toggle button **IN/OUT/DC REELS** of the timeline area:

In its deactivated state the button of the timeline area is labelled **IN/OUT**. In this mode you can see the timeline as usual and set the timeline's in- and outpoint.

When the button is activated, it will be labelled **DC REELS** and the timeline area will show you already set reels. Additionally, the tab **DC reels** of the tool area will be activated. In this mode you can view the DC reels and set their in- and outpoints.

To set reels in the timeline you have two possibilities at hand: You can set them automatically or manually. Both possibilities will be described in this section. Furthermore, it will be described how to edit and configure the reels.

2.3.1 Setting Reels Automatically

The reels for a DCP can be set automatically which is the most convenient way to do this. Afterwards the reels can be altered and configured to your liking manually. To set reels automatically in the timeline do as described in the following:

- Select from the context menu of the timeline scale the menu option ***Set DC reels automatically…***.

This will switch the timeline area to the view of the DC reels automatically and the following window will be displayed on the screen:

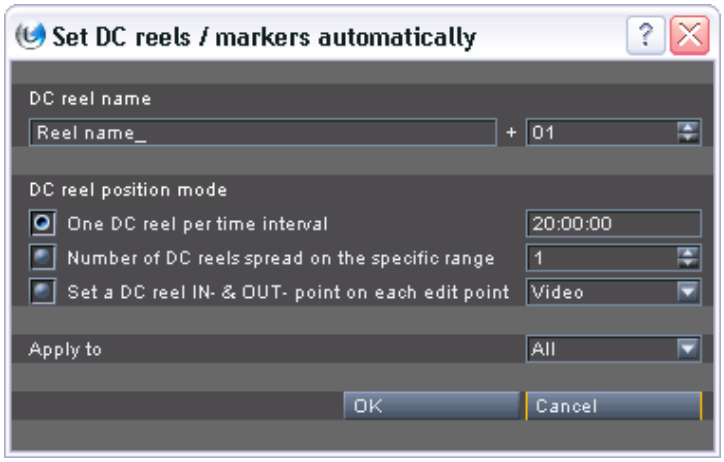


Figure 2-3: Dialog to set reels automatically

It provides the settings items as described below:

Item	Description
DC reel name	These two fields determine the names of the reels. The name prefix as entered in the field to the left will be used for each reel, supplemented by a consecutive numbering that can be configured with the field to the right (start number of the numbering).
DC reel position mode	Determines the way the reels should be generated. Via the radio buttons you can select between one of the following possibilities:
	One DC reel per time interval: With this setting you can set a fixed duration for the reels via the entry field to the right. The timeline/range will then be divided into reels of the stated duration (the last reel may be shorter).
	Number of DC reels …: Use this setting to set a definite number of reels with the entry field to the right. The timeline/range will then be divided into this amount of reels of equal length.

Item	Description
	Set a DC reel …: Use this setting and its combo box to specify that the video and/or audio clips available in the timeline should determine the reels. The reels' in- and outpoints will then be set at the edit points (cuts) of the clips.
Apply to	This setting allows you to limit the procedure. You can perform it either on all clips of the timeline or on the clips of a timeline range only, i.e. between a set in- and outpoint for the timeline.

- Configure the creation of the reels according to your requirements.
- Afterwards create the reels by clicking the **OK** button.

This will start the creation of the reels and when finished, you can see them in the timeline area. After this they can be edited and configured to your liking as described in section "Editing and Configuring the Reels" on page 2-13.

2.3.2 Setting Reels Manually

The reels for a DCP can also be set manually. For this perform the following:

- If not already the case switch to the view of the DC reels by activating the toggle button **IN/OUT/DC REELS** of the timeline area.

When in the DC reels viewing mode, you can use the items to set the timeline's in- and outpoint to determine the DC reels. They can be used in exactly the same way to set the in- and outpoints of the DC reels:

Figure 2-4: Items to set in- and outpoints

- Move the timeline cursor via its controls or manually to the position where the reel's inpoint should be set.
- Then press the button for the inpoint.
- Perform the same for the reel's outpoint.

This will automatically create a DC reel in the timeline with the name `Reel name_<no.>`. By performing the same procedure repeatedly

you can create DC reels manually in the timeline. They can be created and edited in the following ways:

To set reel in-/outpoints and to move within a reel you can also use the provided shortcuts (see section “Keyboard Shortcuts” on page 7-5).

– The reels will be formed by setting an inpoint as well as an outpoint.
– The nearest, free and unobstructed (no already defined reel inbetween) in-/outpoint will be used to form a reel.
– In-/outpoints can also be set by entering a number in the respective entry field and afterwards pressing [Enter].
– Already determined reels can be altered by either setting a new in-/outpoint within an already defined reel (shortens the reel), or by setting a new in-/outpoint and deleting the old one (lengthens the reel).
– When in the DC reels mode, reel in- and outpoints can be deleted the same way as deleting the timeline’s in- and outpoint (by using the toggle button **DELETE**).
– The number <no.> of the reel name will increase by one (1) with each created reel.

Once you are finished with the creation and setting of the DC reels, they can be edited and configured to your liking as described in section “Editing and Configuring the Reels” on page 2-13.

2.3.3 Editing and Configuring the Reels

By activating the toggle button **IN/OUT/DC REELS** you switch the timeline area to the viewing and editing mode for DC reels. This also activates the tab **DC reels** of the tool area. In this mode you can view the DC reels as well as edit and configure them. The timeline area will then show you already set DC reels:

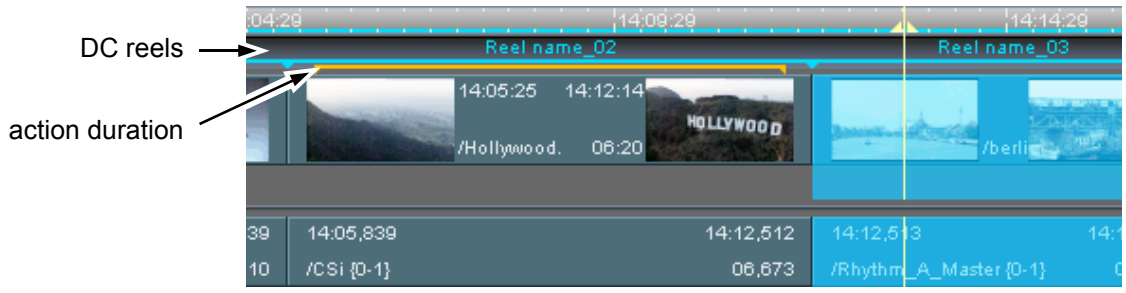


Figure 2-5: DC reels in the timeline area

The DC reels already defined in the timeline will be displayed in the timeline area with a blue line showing the name of the reel right above it. Once the timeline cursor is placed inside a reel, the respective timeline stretch between its in- and outpoint will be highlighted in blue.

With the timeline area switched to the DC reels mode you can set new DC reels manually or edit already determined ones as indicated in section “Setting Reels Manually” on page 2-12. Newly created reel in- and outpoints, when not assigned to a reel already, will be shown in the timeline with an in-/outpoint marker without the blue line.

Apart from editing already determined reels manually in the timeline, they can also be configured with the tab **DC reels** of the tool area as well as with some menu options of the context menu of the timeline scale. Both possibilities will be described in the following.

The Tab 'DC reels'

Already set reels can be configured with the tab **DC reels** of the tool area:

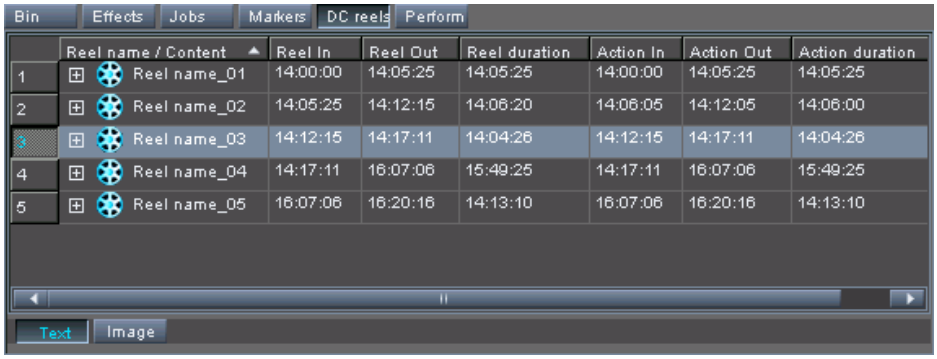


Figure 2-6: The tab 'DC reels'

The tab **DC reels** shows you the already defined DC reels as they can be seen in the timeline. When selecting a reel, for example, with a click of the mouse, the DVS software will switch to the viewing mode for DC reels (if not already activated) and highlight the respective reel in the timeline. Additionally, the timeline cursor will be positioned at the in-point of the selected reel.

The entries on this tab provide information about the exact in- and out-points of the reels as well as their durations. Furthermore, for each reel you can specify an 'action in- and outpoint' (i.e. determine the parameters 'EntryPoint' and 'Duration' of a DCP asset in a CPL). You may use them, for example, if the targeted digital cinema player requires something similar to pre- or postroll times. When an action in- or outpoint is specified, the material of this reel that lies outside the action duration will not be displayed by a digital cinema player, only the material of the action duration will be shown during a presentation. An action duration is marked in the timeline area with an orange line below the blue line

of a reel, and it will appear as soon as one of the action in-/outpoints is set differently than the in-/outpoint of the reel.

An action in-/outpoint can only be placed inbetween the in- and outpoint of its belonging reel.

You can change the values of a reel displayed on the tab **DC reels**, i.e. the names of the reels as well as their in-/outpoints, by double-clicking a particular entry with the mouse and entering a new one. Afterwards confirm the new value with the [Enter] key which will apply it to the respective reel.

When editing a reel's in-/outpoint, they cannot be placed inside another already defined reel or beyond one.

Further information about a reel can be viewed by clicking on the plus/minus (+/-) signs in front of a reel entry. It will expand or collapse the contents of the reel:

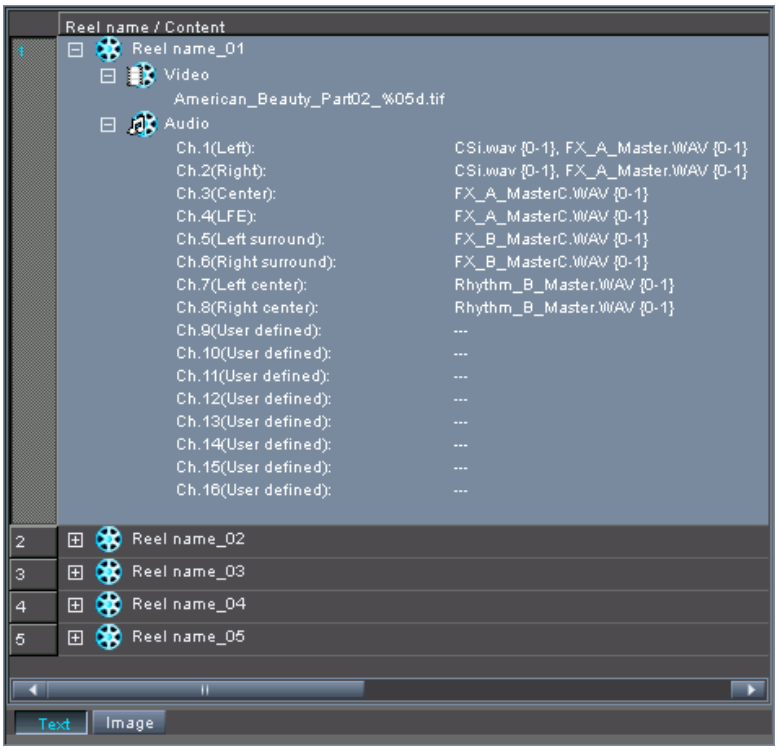


Figure 2-7: The expanded contents of a reel

With this you can easily confirm the contents of a reel and, furthermore, view the mapping of the audio data (routing of the audio tracks, see also section "Possible Formats for a DCI Mastering" on page 2-4).

The Context Menu

The context menu of the timeline scale provides some menu options to help you during the configuration and editing of DC reels. Most of them will be available when the DC reels viewing mode is activated:

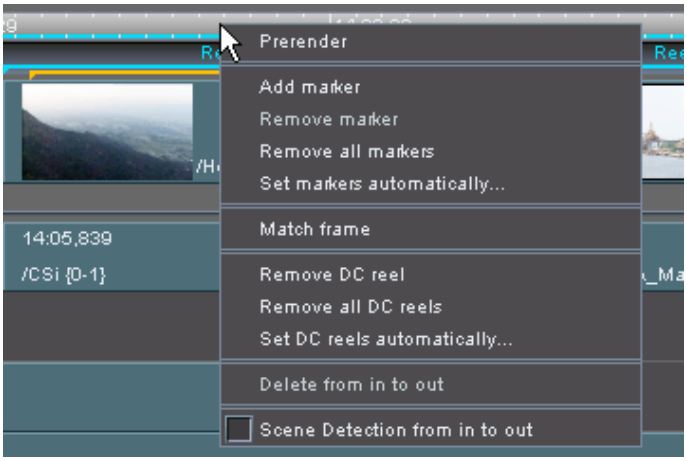


Figure 2-8: The context menu of the timeline scale

The following menu options are available to configure and edit DC reels:

Remove DC reel	This menu option removes the DC reel that is currently selected (highlighted) in the timeline area.
Remove all DC reels	Removes all DC reels defined for the timeline in a single step.
Set DC reels automatically...	With this menu option you can set reels automatically. Further information about this can be found in section "Setting Reels Automatically" on page 2-10.

2.4 Configuring the System for a DCP Creation

For the creation of a DCP you have to make some general settings on the tab **Defaults** of the Configuration Tool of the DVS software and set, for example, the private key to sign the extra files of the DCP (i.e. CPL, KDMs and PKL).

These settings are not required in case you want to create an intermediate step towards a DCP. They are applied during the generation of a DCP only.

Further information about the keys and certificates used during the creation and usage of a DCP can be found in section "Keys and Certificates Explained" on page 7-8, and information about the keys and certificates delivered with the DVS system can be found in section "The Keys and Certificates Delivered with CLIPSTER" on page 7-16.

Because the settings on the tab **Defaults** are general settings for the CLIPSTER software, they will be set and available for each initialized new project. This way you may not have to configure them again when creating other DCPs in the future:

- Open the DCI settings in the CLIPSTER Configuration Tool (menu ***Options » Configuration defaults… »*** group ***DCI***).

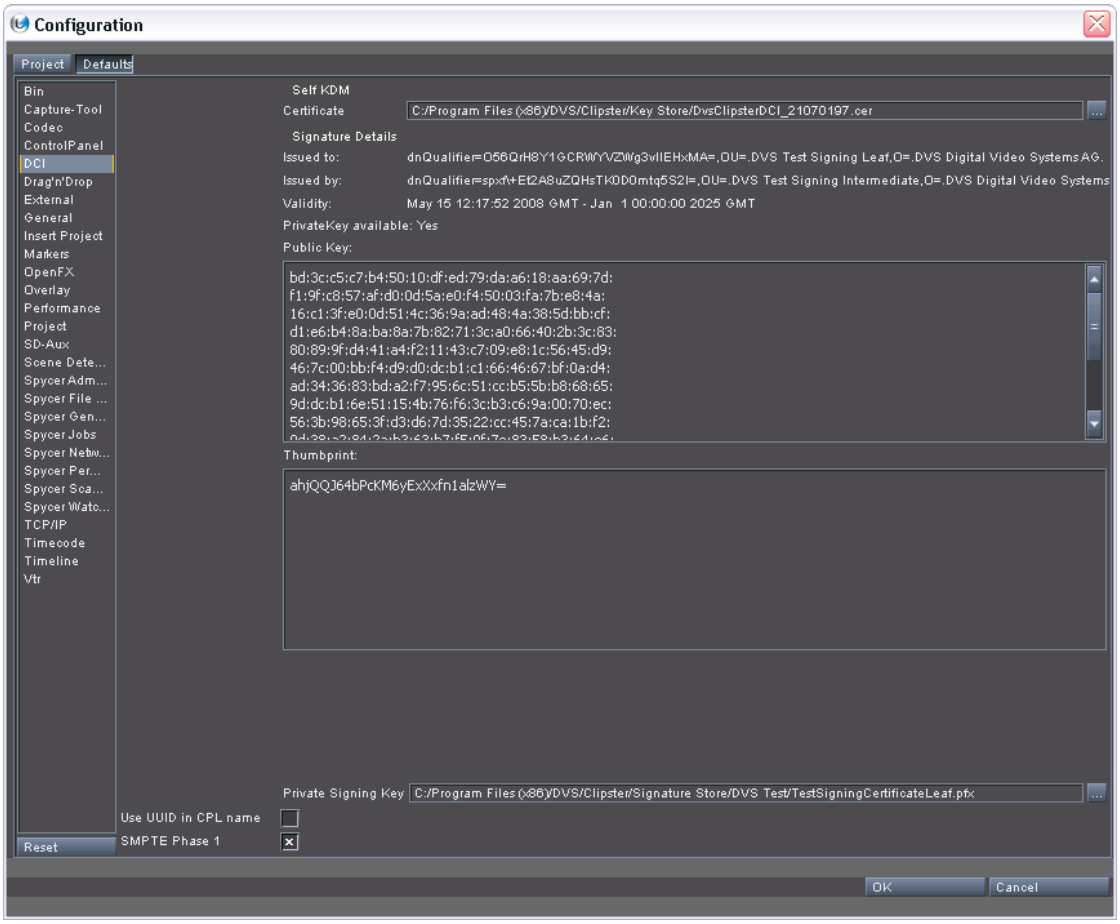


Figure 2-9: DCI configuration settings

- Configure these settings according to your requirements:
  - Use the button ... on the right-hand side of the field **Private Signing Key** to select the private key file (`*.pfx`) that should be used to sign the extra files of the DCP (Signing Key). For this you may have to enter a password to authenticate your usage of the private key. Afterwards the corresponding public key is detailed in the field **Public Key** above. This public key will be attached to the extra files and will be used by D-Cinema players to verify the origin of the files of a DCP.

    Your authentication for the private key will be valid for this session of the software only. After a restart of the DVS software and when performing a DCI Mastering again, you will be asked automatically by the software to enter the password once more.

  - Use the area **Self KDM** with the field **Certificate** to select the public key of a CLIPSTER DCI Mastering system that should be

able to load the DCP, e.g. for quality checks. This public key will then be used during the creation of a DCP to generate a special KDM file (the self KDM). With this KDM you will be able to load the DCP on the respective CLIPSTER (e.g. to view it, to create additional KDMs of the same DCP at a later time, or to modify it). Select the file (`*.cer`) that holds the public key of this CLIPSTER with the button ... to the right of the field **Certificate**.

This public key file can be found either already stored in the installation directory of the CLIPSTER software on the respective system or on a separate CD-ROM.

Further information about the usage of the self KDM as well as its creation can be found in chapter "Using the DCP and Self KDM" on page 4-1.

– Activate the check box **Use UUID in CPL name** to get a shorter version for the file name of the CPL based on its UUID (universally unique identifier, file name syntax will be `CPL_<UUID>.xml`). If deactivated, the file name of the DCP will be used.
– An activated check box **SMPTE Phase 1** creates a DCP that is SMPTE/DCI compliant. You have to deactivate the check box to generate a DCP for D-Cinema players which are based on the MPEG or JPEG Interop instead of the SMPTE standard.

Further information about this can be found in section "DCP Standards" on page 2-6.

• After these settings are determined confirm them by clicking on the **OK** button.

With this the project and system are properly prepared for a DCI Mastering and you can start one at any time as described in section "How to Start a DCI Mastering" on page 2-20.

2.5 How to Start a DCI Mastering

As soon as the preparations appropriate for your source material are finished as described in this chapter, you can start a DCI Mastering and create material for digital cinema workflows. There are two ways to create such material:

digital cinema delivery tool	With the digital cinema delivery tool you can create JPEG2000 compressed DCPs or an intermediate state towards one. DCPs can be created either JPEG Interop or SMPTE/DCI compliant (see section "DCP Standards" on page 2-6). This tool is the recommended way to create D-Cinema material because it will lead you step by step through the different configurations necessary to create digital cinema content.
manual creation	Every state towards a DCP or the final DCP itself can also be created manually via finalizing(s) with the Edit Tool. When using this way to create digital cinema content, you are more flexible regarding the created output, e.g. you can create MPEG compressed DCPs (MPEG Interop, see section "DCP Standards" on page 2-6). As the name suggests, however, this way of creating digital cinema material is not as intuitive and forthcoming as when using the digital cinema delivery tool.

How to use the digital cinema delivery tool to create DCPs or an intermediate result is described in chapter "Digital Cinema Delivery Tool" on page 3-1.

How to manually create a final DCP or an intermediate result with the Edit Tool via finalizing is described in chapter "Manual Creation of a DCP" on page 6-1.

Digital Cinema Delivery Tool

The digital cinema delivery tool is the recommended tool to create JPEG2000 compressed DCPs or an intermediate state towards one. Its usage is most convenient because it will lead you step by step through the different configurations required to create a DCP. With it you will be able to create digital cinema content that is JPEG Interop or SMPTE/DCI compliant (see section "DCP Standards" on page 2-6).

This chapter explains the digital cinema delivery tool in detail. First, it will be described how to get the delivery tool started, followed by an overview of its user interface. After this the individual configuration steps will be described.

Because some of the configuration steps are not required for certain delivery types, the section where you have to select the delivery type will also summarize the steps that are necessary for a delivery type. Subsequently all configuration steps will be described, i.e. as they would have to be specified when creating an encrypted DCP.

Once you are through with the steps/screens of the digital cinema delivery tool, the chosen delivery type can be created. This chapter will be concluded with a description of the resulting output that can be expected.

3.1 Starting the Digital Cinema Delivery Tool

To get the digital cinema delivery tool started perform the following:

- Prepare your source data in the timeline of the Edit Tool as described in chapter “Getting Started” on page 2-1.
- Then select ***Project » Digital Cinema Delivery Tool...*** from the menu bar of the DVS software.
  Alternatively, you can use the keyboard shortcut [Ctrl + D].

This will start the digital cinema delivery tool and the first configuration step is displayed on the screen (see section “Overview” on page 3-3 and section “Delivery Type” on page 3-5).

3.2 Overview

After starting the digital cinema delivery tool (see section “Starting the Digital Cinema Delivery Tool” on page 3-2) its user interface is displayed on the screen, showing you the first configuration step:

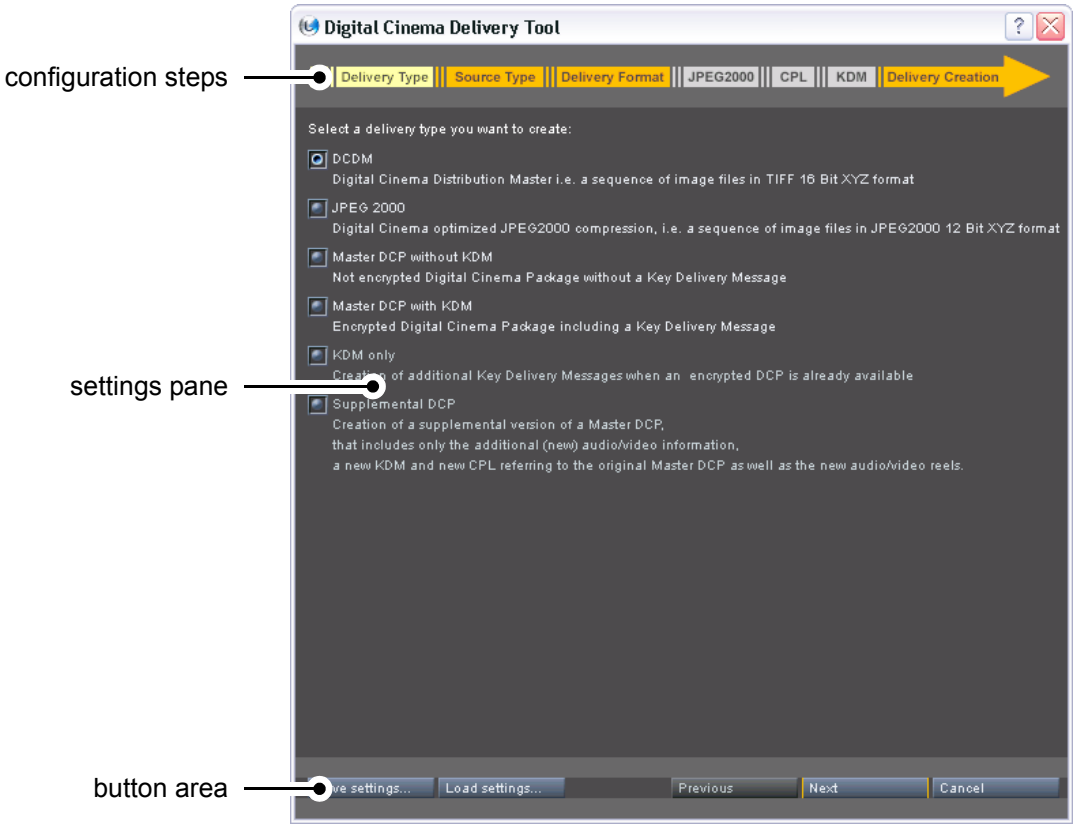

configuration steps
settings pane
button area
Digital Cinema Delivery Tool
Delivery Type
Source Type
Delivery Format
JPEG2000
CPL
KDM
Delivery Creation
Select a delivery type you want to create:
DCDM
Digital Cinema Distribution Master i.e. a sequence of image files in TIFF 16 Bit XYZ format
JPEG 2000
Digital Cinema optimized JPEG2000 compression, i.e. a sequence of image files in JPEG2000 12 Bit XYZ format
Master DCP without KDM
Not encrypted Digital Cinema Package without a Key Delivery Message
Master DCP with KDM
Encrypted Digital Cinema Package including a Key Delivery Message
KDM only
Supplemental DCP
Creation of a supplemental version of a Master DCP,
that includes only the additional (new) audio/video information,
a new KDM and new CPL referring to the original Master DCP as well as the new audio/video reels.
Load settings...
Previous
Next
Cancel

Figure 3-1: The digital cinema delivery tool

The arrow at the top of the window of the digital cinema delivery tool shows you the configuration steps that would have to be performed for the currently selected delivery type. Depending on the selected delivery type there are different configuration steps required and the arrow indicates them with different colors:

yellow	The current configuration step.
orange	Configuration steps which have to be performed for the selected delivery type.
grey	Configuration steps that are not required for the selected delivery type and cannot be made.

Further details about the delivery types and the required configuration steps can be found in section “Delivery Type” on page 3-5.

The configurations that can be made for the currently displayed configuration step are shown in the settings pane in the middle of the window. When you are finished with the configurations for the current step, you can go to the next or previous configuration step with the appropriate buttons in the button area at the bottom of the window.

The buttons of the button area allow you to control the digital cinema delivery tool:

Saves the already specified configuration settings for the digital cinema delivery tool to a file.

Loads previously saved configuration settings from a file.

Steps to the previous configuration step for the currently selected delivery type.

Steps to the next configuration step for the currently selected delivery type. When the last step is reached, it will be labelled 'Create', which will then start the creation of the digital cinema content.

Closes the digital cinema delivery tool without creating digital cinema content. However, already specified configurations will not be lost but stored during run-time.

Already made configuration settings are saved in a project file as well.

3.3 The Configuration Steps

This section explains the settings possibilities of the configuration steps in detail. Depending on the selected delivery type (see section "Delivery Type" on page 3-5) there are different configuration steps required and this section explains them as they would appear when creating an encrypted DCP. The configuration steps that are required for a delivery type are summarized in section "Delivery Type" on page 3-5.

3.3.1 Delivery Type

Right after starting the digital cinema delivery tool (see section "Starting the Digital Cinema Delivery Tool" on page 3-2), the very first configuration step will be displayed. With it you determine the type of content that should be created, i.e. the delivery type.

Digital Cinema Delivery Tool
Delivery Type
Source Type
Delivery Format
JPEG2000
CPL
KDM
Delivery Creation
Select a delivery type you want to create:
DCDM
Digital Cinema Distribution Master i.e. a sequence of image files in TIFF 16 Bit XYZ format
JPEG 2000
Digital Cinema optimized JPEG2000 compression, i.e. a sequence of image files in JPEG2000 12 Bit XYZ format
Master DCP without KDM
Not encrypted Digital Cinema Package without a Key Delivery Message
Master DCP with KDM
Encrypted Digital Cinema Package including a Key Delivery Message
KDM only
Creation of additional Key Delivery Messages when an encrypted DCP is already available
Supplemental DCP
Creation of a supplemental version of a Master DCP,
that includes only the additional (new) audio/video information,
a new KDM and new CPL referring to the original Master DCP as well as the new audio/video reels.
Save settings...
Load settings...
Previous
Next
Cancel

Figure 3-2: The delivery type settings

In the settings pane select the delivery type that you want to create by activating one of the available radio buttons. When finished you can go to the next configuration step with the button **NEXT**.

Depending on the selected delivery type there are different configuration steps required. The following explains shortly the available delivery types and details the configuration steps that have to be performed for each.

Please note that for the last two options an already created DCP is required and, if the DCP is encrypted, a self KDM for the DCP.

'DCDM'

This option creates a DCDM from a DSM, i.e. a sequence of TIFF image files in 16 bit X'Y'Z' (see also section "Digital Cinema Distribution Master (DCDM)" on page 2-3). For this the following configuration steps are necessary:

Figure 3-3: Configuration steps for a DCDM

For some particulars about the creation of a DCDM see section "Color Space Conversions" on page 7-2.

'JPEG2000'

This option creates JPEG2000 compressed data optimized for the digital cinema either from a DSM or DCDM in a single step, i.e. a sequence of JPEG2000 files in 12 bit X'Y'Z' (see also section "JPEG2000" on page 2-3). For this the following configuration steps are necessary:

Figure 3-4: Configuration steps for JPEG2000 data

'Master DCP without KDM'

This option creates an unencrypted DCP (e.g. for trailers or advertisements) either from a DSM, a DCDM or digital cinema compliant JPEG2000 data in a single step (see also section "Digital Cinema Package (DCP)" on page 2-4). Afterwards this DCP can be used as a master

for later adaptations (supplemental DCP). For a DCP without KDM the following configuration steps are necessary:

Figure 3-5: Configuration steps for a DCP without KDM

'Master DCP with KDM'

This option creates an encrypted DCP (e.g. for a feature film) either from a DSM, a DCDM or digital cinema compliant JPEG2000 data in a single step (see also section "Digital Cinema Package (DCP)" on page 2-4). Afterwards this DCP can be used as a master for later adaptations (supplemental DCP). In case you have an unencrypted DCP, you can use this option to encrypt it.

An unencrypted DCP can also be encrypted via a finalizing (see section "Modifying a DCP Manually" on page 6-12).

For an encrypted DCP the following configuration steps are necessary:

Figure 3-6: Configuration steps for a DCP with KDM

'KDM only'

This option allows you to create additional KDMs (e.g. for later releases of the same encrypted DCP) without generating the DCP again. It will be available when an encrypted DCP has been loaded into CLIPSTER (see section "Creating Additional KDMs (KDM only)" on page 4-6). For this the following configuration steps are necessary:

Figure 3-7: Configuration steps for a DCDM

'Supplemental DCP'

This option allows you to create additional material for an already generated DCP (master DCP). It will be available when a DCP (encrypted or unencrypted) has been loaded into CLIPSTER (see section "Modify-

ing a DCP (Supplemental DCP)" on page 4-7). For this the following configuration steps are necessary:

Figure 3-8: Configuration steps for a supplemental DCP

Whether the configuration step for a KDM is required depends on whether an encrypted or unencrypted DCP has been loaded.

An unencrypted DCP can be encrypted either with the option **Master DCP with KDM** or via a finalizing (see section "Modifying a DCP Manually" on page 6-12).

3.3.2 Source Type

With the source type configuration step you determine the color space and color profile (type) of your source material in the timeline:

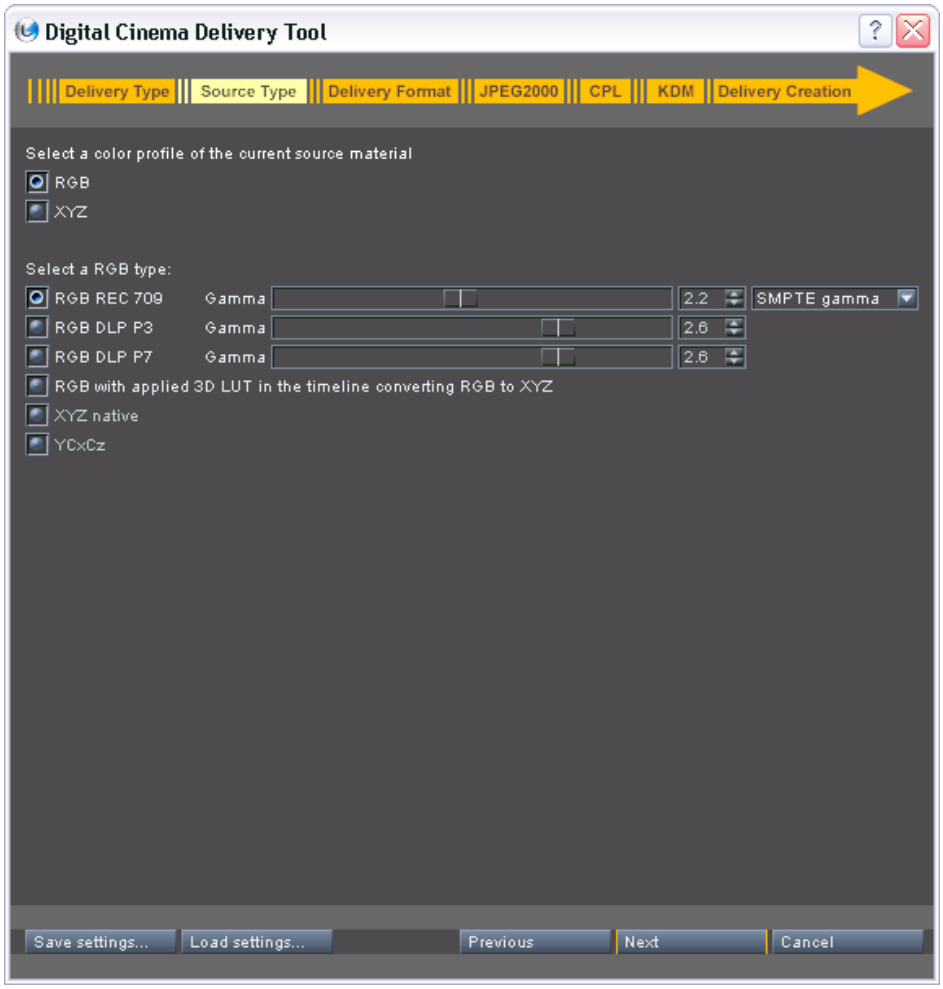


Figure 3-9: The source type settings

Further information about color space conversions can be found in section “Color Space Conversions” on page 7-2.

Via the radio buttons at the top of the settings area you have to select the color space of your source material in the timeline:

RGB	If the timeline consists of clips in the RGB color space only, you have to activate this radio button.
XYZ	Select this setting if the clips in the timeline are all in the X′Y′Z′ color space.

Depending on the selected color space the radio buttons in the middle of the settings area will be made available. With them you have to spec-

ify how to interpret the color space of the source material in the timeline or, in other words, the color profile/type of the selected color space:

RGB REC 709	Activate this radio button if your material is stored in the REC 709 color profile. You can adjust the gamma (luminance) of the output with the items to the right: When switching the combo box to the right from `SMPTE gamma` (the default gamma as specified by SMPTE which cannot be adjusted) to another setting, the slider will be made available. Then the gamma value can be changed via the slider or the entry field to the right.
RGB DLP P3	Activate this radio button if your material is stored in the DLP P3 color profile. With the slider and the entry field to the right you can adjust the gamma (luminance) of the output.
RGB DLP P7	Activate this radio button if your material is stored in the DLP P7 color profile. With the slider and the entry field to the right you can adjust the gamma (luminance) of the output.
RGB with applied 3D LUT…	This setting will be available when a user-defined 3D LUT has been applied to the timeline. When activated, this 3D LUT will be used for the color conversion.
XYZ native	Activate this radio button if your material is stored in the X′Y′Z′ color space already. Then no color conversion will be performed.
YCxCz	If you material was processed with a YUV matrix, this setting has to be activated. The bin clip properties of these clips in the timeline have to be set to YUV with the appropriate YUV matrix selected that was used to process the material (see also section "The Steps to Prepare a DCDM" on page 2-7).

When everything is set up correctly, you can go to the next configuration step with the button **NEXT**.

3.3.3 Delivery Format

The delivery format configuration step is used to determine the output format of the digital cinema content.

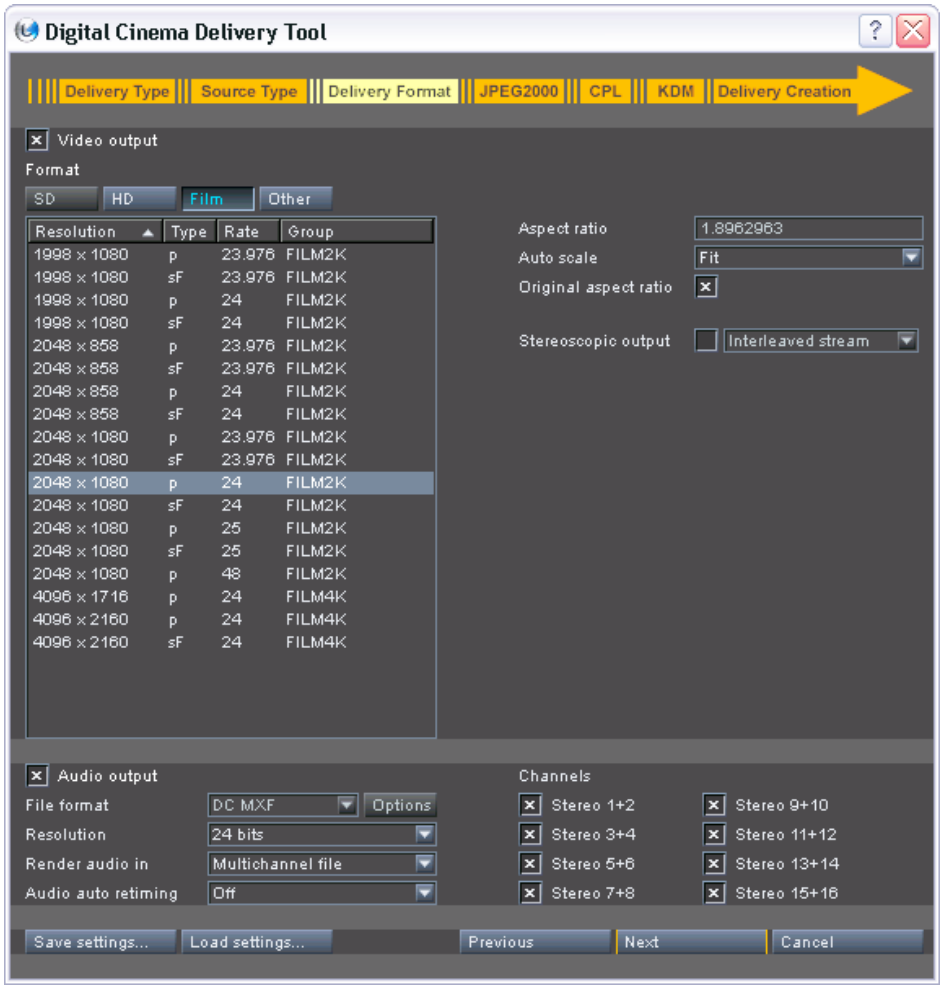


Figure 3-10: The delivery format settings

Depending on the type of material that is available in the timeline (video and/or audio) the respective output types will already be activated.

In the settings pane use the buttons, the list box and the settings items for the video output to specify the video format. Adjust them so that they match your desired output format (normally the one of the final DCP, see section “Possible Formats for a DCI Mastering” on page 2-4).

Additionally, specify the audio format for the digital cinema content according to your needs, for example, select the WAV file format in 24 bit as a multi-channel file.

Audio retiming should be activated when the output frame rate differs from the one selected for the timeline.

These settings items are almost identical to the ones used in the finalize dialog. For further information about them see the "CLIPSTER Edit Tool" user guide.

For details about the **Stereoscopic output** item refer to section "Creating a 3D DCP" on page 5-14.

After this the configurations for the delivery format are complete and you can go to the next configuration step with the button **NEXT**.

3.3.4 JPEG2000

With the JPEG2000 configuration step you configure the JPEG2000 compression rate for the digital cinema content.

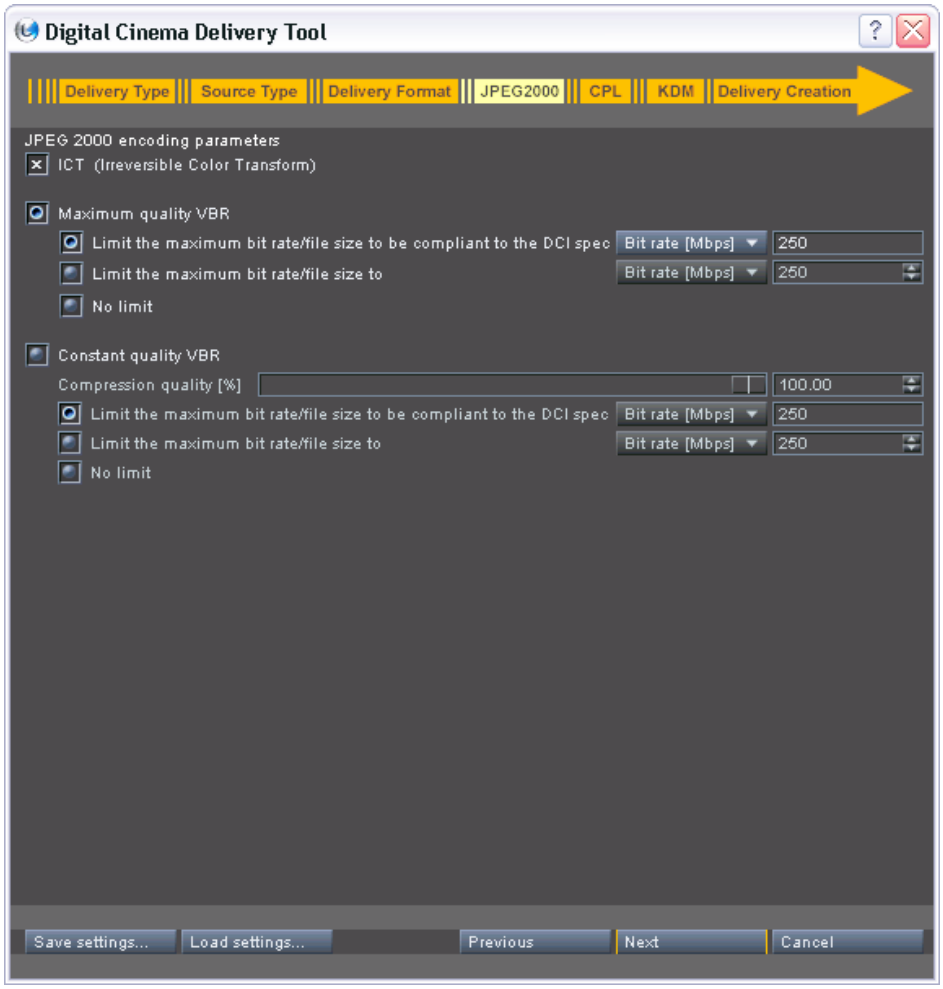


Figure 3-11: The JPEG2000 settings

By default the settings are set to the highest quality allowed for a DCP. Further details about the JPEG2000 encoding can be found in section “JPEG2000” on page 2-3.

This configuration step provides the following settings items:

ICT
This setting enables the Irreversible Color Transform, meaning an internal conversion of the images' colors prior to encoding. With this the colors of the images will be encoded more efficiently. If the check box is deactivated, the original colors of the images will be used for the encoding, which would normally result in a larger file size per image, but with one of the **Limit the maximum bit rate/file size…** settings activated it will result in a lower quality of the finalized material.

Maximum quality VBR
With this setting activated the applied JPEG2000 encoding will get the maximum quality out of each processed image. It can be specified further with the settings sorted under it:

- **Limit the maximum bit rate/file size to be compliant to the DCI spec**: This setting enables the post compression rate control. It is available for convenience reasons, already providing the optimum settings for digital cinema content. The settings cannot be altered.
- **Limit the maximum bit rate/file size to**: This setting enables the post compression rate control. When it is activated, the limitation values can be adjusted. Select whether you want to adjust the bit rate or the file size from the drop-down list and then change its value in the entry field to the right to the desired one.
- **No limit**: This setting disables the post compression rate control, meaning a JPEG2000 compression will still be performed but without further bit rate/file size limitation, resulting in the highest quality and the largest file sizes (e.g. between 2 and 3 MB for 2K images).

Constant quality VBR
The constant quality VBR setting operates near the maximum quality VBR (when set to 100 %). During encoding it tries to get the same quality for the complete timeline so that you will receive the same impression for each image. It can be specified further with the settings sorted under it, which operate the same way as for the maximum quality VBR (see above).

When everything is set up correctly, you can go to the next configuration step with the button **NEXT**.

3.3.5 CPL

When creating a DCP, you also have to perform the configuration step for a Composition Playlist (CPL).

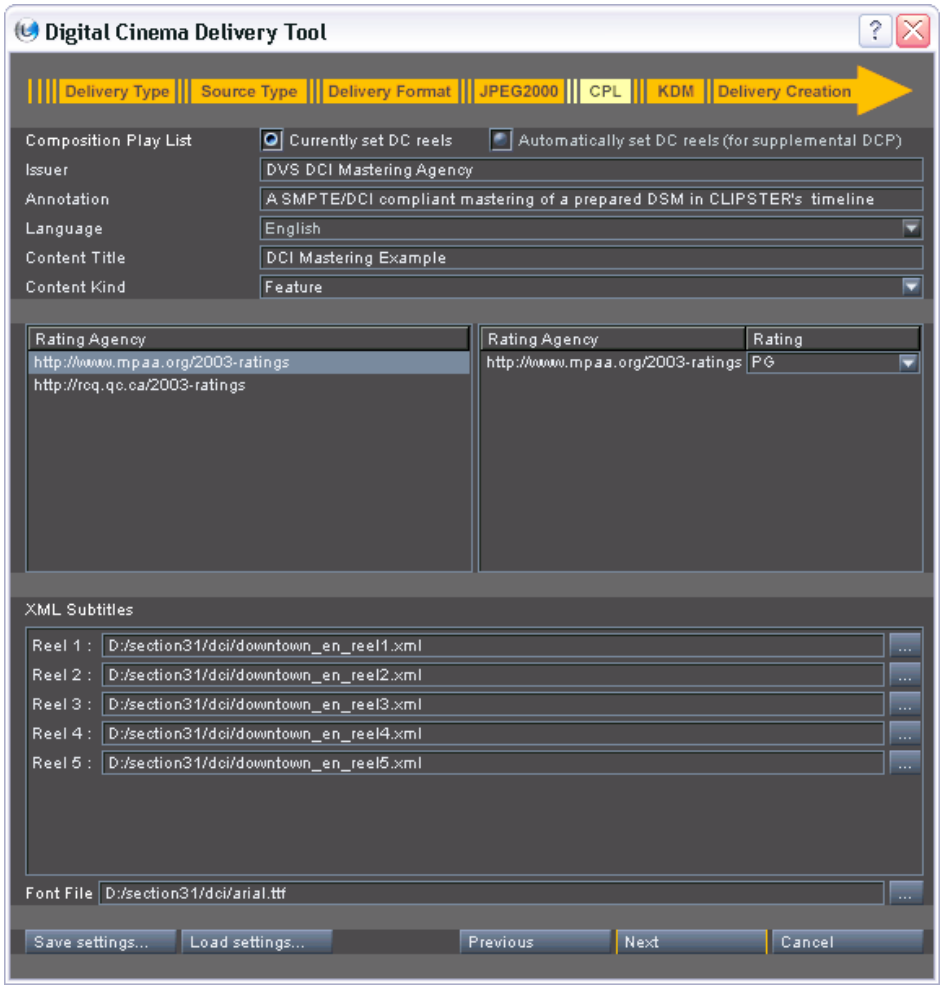


Figure 3-12: The CPL settings

In the settings pane configure the CPL to be generated to your requirements:

For details about the **Currently set DC reels** and the **Automatically set DC reels** items please refer to section "Modifying a DCP (Supplemental DCP)" on page 4-7.

With the entry fields in the upper part of the window you can provide details about the DCP to be created. They will be written to the CPL file. As a minimum setting the **Content Title** is required.

To include a rating for the DCP to be created you have to use the two list fields. Select the applicable rating agency in the list field to the left with the mouse. Then drag and drop it to the list field to the right. Afterwards adjust the rating with the provided combo box. An already set

rating and rating agency can be removed from the list field to the right by pressing the [Del] key on your keyboard.

The rating and rating agencies can be adapted. Further information about this can be found in section "Adapting the Rating Agencies" on page 7-4.

If DC reels are set in the timeline of the Edit Tool (see section "Setting Reels" on page 2-10), you can add subtitles for the DCP in the area **XML Subtitles**. For each specified reel there will be one entry field available where you have to enter the path to the **.xml* subtitle file. Alternatively you can select the file with the button to the right of the entry field (...). To add a subtitle file at least one reel has to be specified in the timeline. These files must be already available and one **.xml* file has to be assigned to each reel.

Via the entry field **Font File** you have to select the font that the subtitles should be displayed in (true type font, **.ttf*).

Currently it is not possible to review or display subtitles with the DVS software. However, the D-Cinema player will recompose them from the provided **.xml* files during presentation.

After this the configurations for the CPL are complete and you can go to the next configuration step with the button **NEXT**.

3.3.6 KDM

If you create an encrypted DCP, one or more Key Delivery Messages (KDMs) have to be created as well. They will contain the encrypted AES key to decrypt the content of the DCP. Usually you will create one KDM for each D-Cinema player that should play out the content and for this the respective public key of the D-Cinema player is required. The generation of the KDMs as well as the keys that should be used can be configured with the KDM configuration step.

Further information about the keys and certificates used during the creation and usage of a DCP can be found in section "Keys and Certificates Explained" on page 7-8.

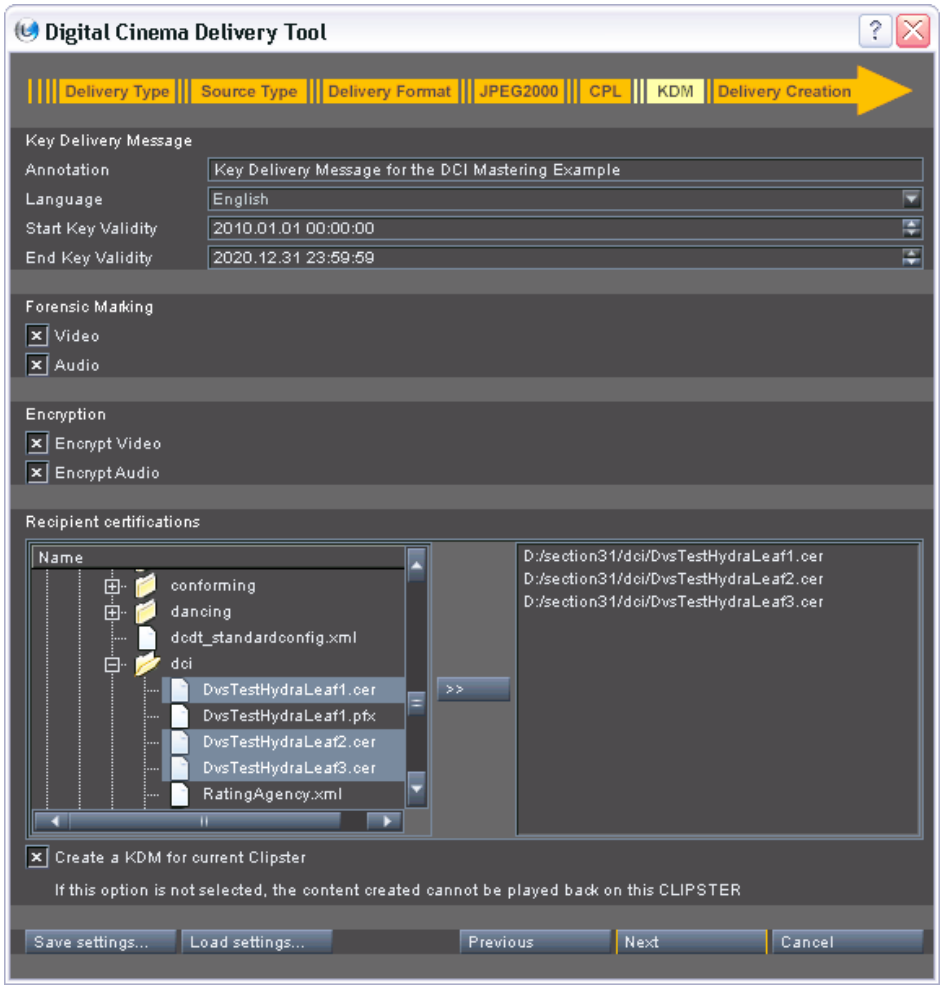


Figure 3-13: The KDM settings

In the settings pane configure the generation of the KDM(s) according to your needs:

With the entry and date/time fields in the upper part of the window you have to provide further details about the KDM(s) to be created as well as their validity. For the generation of a KDM a correct time setting

is essential. Date/time entries are standardized and must be given in the format `YYYY.MM.DD hh:mm:ss`.

In the area **Forensic Marking** you can select whether the D-Cinema players should apply a watermarking to the played out video and/or audio data. It is a flag that will be set in the KDM and interpreted by the players.

Via the **Encryption** settings an encryption of the content can be turned on or off. With the respective check boxes you can select the material that should be encrypted.

In the area **Recipient certifications** you can select the public keys of the D-Cinema players (recipient certificates, Encryption Key) that should be able to play out the DCP. For each selected key one KDM file will be created. In the directory/file tree to the left browse to the location on your system where the public keys (certificates) of the D-Cinema players are stored (*`*.cer`* or *`*.pem`* file). Then select them and transfer them to the list field to the right by either dragging and dropping them with the mouse or using the transfer button (>>). An already set key file can be removed from the list to the right by selecting it and pressing the [Del] key on your keyboard.

With the check box **Create a KDM for current CLIPSTER** you can activate the creation of a self KDM, i.e. of a KDM to decrypt the contents of the final DCP on a selectable CLIPSTER DCI Mastering system, for example, for a final check of the delivered content.

Further information about the usage of the self KDM as well as its creation can be found in chapter “Using the DCP and Self KDM” on page 4-1.

After this the configurations for the KDMs are complete and you can go to the next configuration step with the button **NEXT**.

3.3.7 Delivery Creation

The delivery creation configuration step is the last step to be performed before the digital cinema content is created. With it you can check the material of a DCP as well as specify further output settings such as the path where the content to be created should be stored:

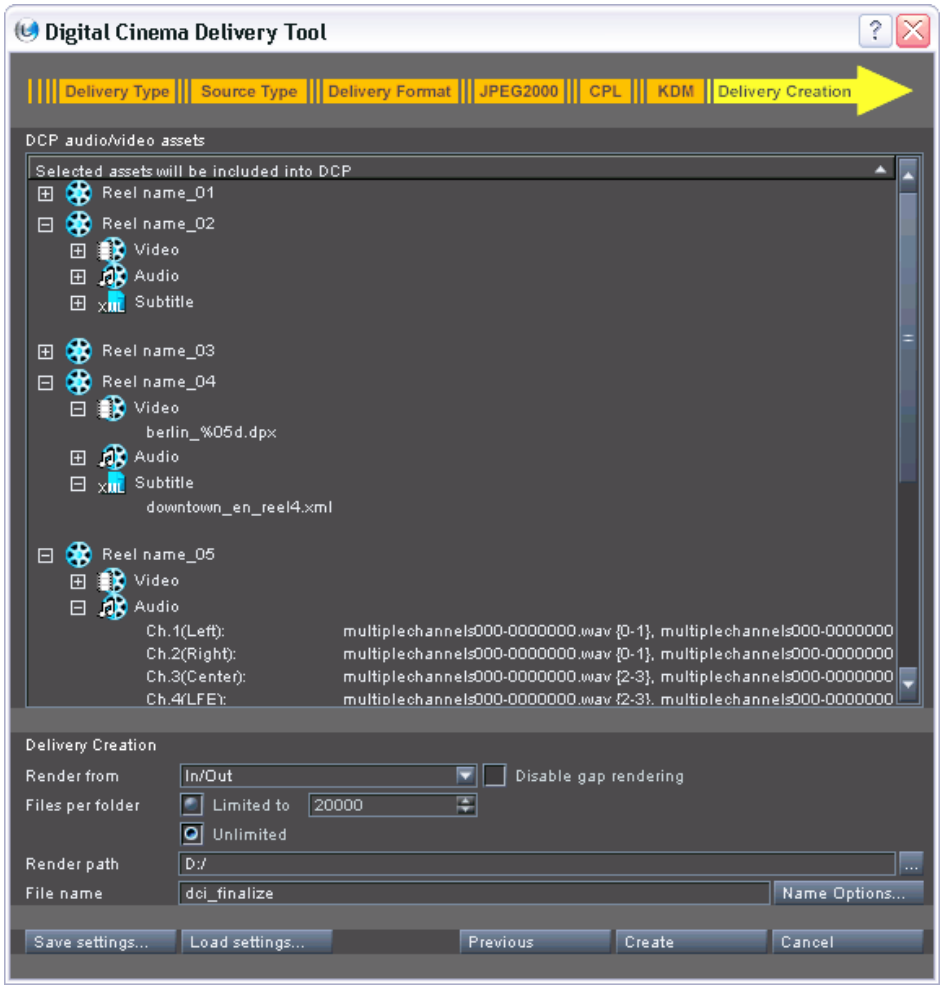


Figure 3-14: The delivery creation settings

The area **DCP audio/video assets** will provide information when you create a DCP and at least one DC reel is specified in the timeline. Then it will show you the DC reels as defined in the timeline and their assets. By clicking on a plus/minus (+/-) sign in front of an entry the assets of the reel can be expanded or collapsed, thereby providing you with further details about them. With this you can easily check and confirm the material of each reel of the DCP down to its source.

With the settings in the area **Delivery Creation** you can specify the output of the digital cinema content further and determine, for exam-

ple, its storage location and name. To set the file name(s) you can also use a variable naming with the button **NAME OPTIONS...**.

The settings items of the area **Delivery Creation** are almost identical to the ones used in the finalize dialog. For further information about them see the "CLIPSTER Edit Tool" user guide.

A click on the button **CREATE** will close the digital cinema delivery tool and start the finalizing process to generate the digital cinema content according to your settings at the specified location (see section "The Generated Files" on page 3-21).

3.4 The Generated Files

The generation of the digital cinema content initiates a standard finalizing process that will create the content according to your settings. The output of DCDM or JPEG2000 files will be as described in the "CLIPSTER Edit Tool" user guide.

When creating a DCP (SPMTE Phase 1), the finalizing generates the JPEG2000 video files in 12 bit as well as the audio data and afterwards wraps them in separate MXF containers. If reels were set in the timeline, you will receive for each reel one MXF file per output format (video and/or audio). The specified subtitle files for the reels will be sorted into subfolders. Furthermore, this step also creates the CPL, the KDM(s), a PKL, an Asset Map file, as well as a Volume Index file.

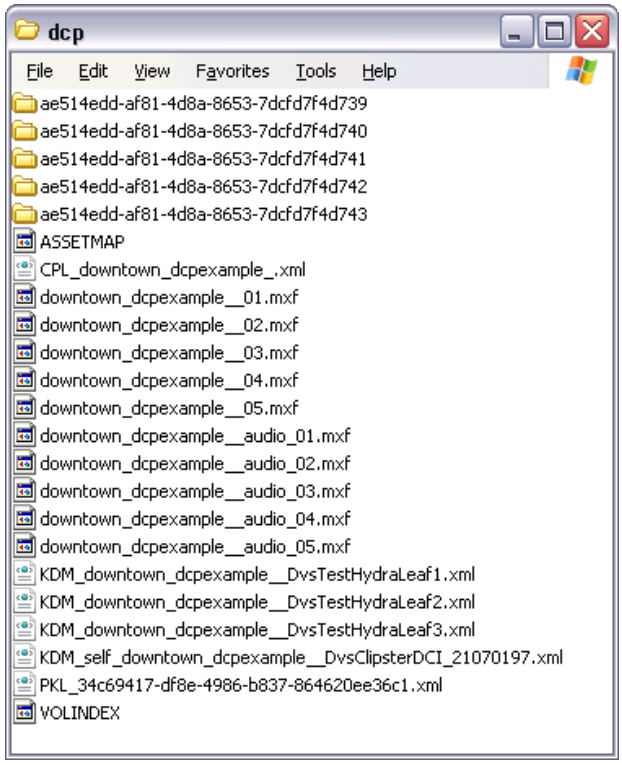


Figure 3-15: The resulting DCP

The following table lists shortly the generated files and their purpose:

File/Folder	Explanation
subfolders	The subfolders hold each a subtitle file (`*.xml`) and the font file (`*.ttf`) in which to display the subtitles. They are named according to the ID of the subtitle file (tag `<SubtitleID>`).

File/Folder	Explanation
ASSETMAP	The Asset Map details the content of the delivered DCP and the paths to its files relative to the Asset Map. It can be loaded by D-Cinema players which use it to reconstruct the track files.
CPL_*.xml	Composition Playlist specifying the sequence of the track files and thus the order of the playout. Contains hash values of the DCP's track files, certificates and a signature for verification purposes as well.
**.mxf*	The (encrypted) content of the DCP (track files), i.e. for each reel one video and one audio file.
KDM_*.xml	Key Delivery Message containing the encrypted key for the content as well as certificates and a signature for verification purposes. One for each playback system (D-Cinema player).
KDM_self_*.xml	Key Delivery Message for a CLIPSTER DCI Mastering system. The self KDM is not intended for D-Cinema players and should only be used to administer the DCP on site (e.g. for quality checks). This file is essential to create new KDMs or load the DCP (see chapter "Using the DCP and Self KDM" on page 4-1).
PKL_*.xml	Packing List containing information and IDs about the files of a DCP. Thus it allows for asset management of the delivered DCP. Contains hash values of most of the DCP's files, certificates and a signature for verification purposes as well.
VOLINDEX	The Volume Index is used to differentiate volumes in a multiple-volume distribution. The creation of a multi-volume distribution is currently not supported.

Once these files are available, you have successfully created a compliant Digital Cinema Package (DCP) with the DVS software that is ready for distribution.

Using the DCP and Self KDM

When a DCP of a feature film is created, it is usually encrypted with the decryption key stored in the KDMs. The decryption key in each KDM is also encrypted, and it can be decrypted only with the private key of the respective D-Cinema player for whom it was created. The conclusion of this is that, once an encrypted DCP is created, it cannot be modified or checked for flaws that may have occurred during the encoding and/or wrapping processes. The DCP together with a KDM and all other extra files are self-contained, intended only for a specific usage in a defined period of time on a particular device.

DVS's solution to this problem is the self KDM of CLIPSTER that can be created together with the other KDMs. It has to be generated with the public key of a CLIPSTER DCI Mastering system, which can be either the one used to create the DCP (most probably the one you are currently working on) or any other one. This CLIPSTER DCI Mastering system can then be used to load the DCP. Although the self KDM carries a validity same as the other KDMs, with CLIPSTER you will be able to use the content nonetheless even if the validity has expired.

Once the DCP is loaded into CLIPSTER with the self KDM, you can, for example, play it out and check its content, create other KDMs (e.g. for later releases) or modify it (e.g. exchange audio). Additional rendering/encoding processes will only be performed where alterations were made, i.e. the DCP will not be generated again completely.

The self KDM is essential if you want to create new KDMs for an already generated DCP.

DCPs can also be created unencrypted, for example, for trailers or advertisements. Then, of course, they do not require KDMs or a self KDM. Unencrypted DCPs as well can be used as described in this chapter, but do not require a self KDM.

This section describes how to use a DCP and a self KDM once they have been created. It will be explained, for example, how to configure the creation of a self KDM, how to load a DCP with the DVS software, how to use a DCP to create additional KDMs, and how to modify a DCP (e.g. for localized versions).

4.1 Configurations for a Self KDM

The necessary configurations to create a self KDM have to be made during the preparations of the system and its software:

1.	During the general preparations to use the DCI Mastering (see section "Configuring the System for a DCP Creation" on page 2-17) some settings have to be made in the Configuration Tool (tab **Defaults** » group ***DCI***): In the field **Certificate** of the area **Self KDM** you have to enter the path to the file (`*.cer`) that holds the public key of the CLIPSTER DCI Mastering system where the DCP should be loaded. *Figure 4-1: Setting the public key for a CLIPSTER DCI Mastering system* This public key file can be found either already stored in the installation directory of the CLIPSTER software on the respective system or on a separate CD-ROM. Because the settings on the **Defaults** tab are general settings of the DVS software, they will be set and available for each initialized new project. This way you do not have to configure the path and file name of the public key file of the respective CLIPSTER again when creating other DCPs in the future.
2.	In the KDM settings during the configurations of a DCP creation, you have to activate the generation of the self KDM. For this enable the check box **Create a KDM for current Clipster** (see section "KDM" on page 3-17 and section "Finalize Settings – KDM" on page 6-9). *Figure 4-2: Activating the creation of the self KDM*

The described procedures to create a self KDM are available for convenience reason: You have to set it only once and its generation can be turned on or off via the check box described above. However, a self KDM is just another KDM, only that it is made for a DVS DCI Mastering system. If wanted, you may create a self KDM the same way as any other KDM.

Once these settings are made, the self KDM will be created during the generation of the DCP. It will be stored at the same location as the other files of the DCP (normally with the file name `KDM_self_*.xml`). This file will then be used to load the encrypted DCP on the DVS system for which it has been created, for example, for quality checks.

4.2 Loading the DCP

After a DCP has been created it can be loaded with the DVS software. Unencrypted DCPs can be loaded on every DVS system that provides the DCI Mastering feature. Encrypted DCPs, however, require a self KDM and can be loaded only on the system for which the self KDM has been intended, i.e. on the DCI Mastering system that holds the complementary key (private RSA key) to the public key that was entered in the Configuration Tool (see section "Configurations for a Self KDM" on page 4-2).

To load a DCP perform the following:

- In the DVS software open the dialog window to load a project (***Project » Open…***).
- Switch to the directory where the DCP or, more explicitly, the CPL is stored.
- Select as the file type to be displayed in the **'Load Project'** window the setting `Digital Cinema Composition Playlist files` (combo box **Files of type**):

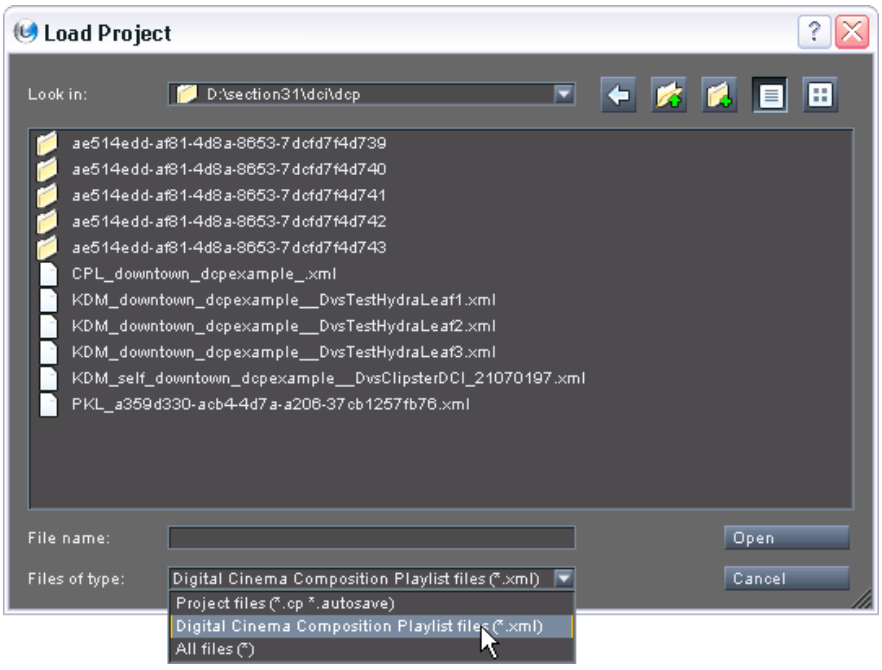


Figure 4-3: Loading the Composition Playlist (CPL) of a DCP

The extra files of the DCP (in `*.xml` format) will be displayed in the dialog window.

- Select the CPL of the DCP that you want to load and open it with the DVS software by clicking the button **OPEN**.

This will check the CPL if the DCP contains encrypted content. When this is the case, the DVS software will search for an appropriate KDM

for the DCP (i.e. the self KDM) in the directory level of the extra files of the DCP. If none can be found, a dialog window for the selection of a file will appear, asking you for the location of the file. Once the KDM has been found and/or loaded, the content of the DCP will be opened in the Edit Tool and you will see it in the timeline.

Afterwards you can use the DCP, for example, to play out the timeline and review the content of the DCP for quality checks.

A loaded CPL is not a DVS project file. Therefore, certain settings may not be configured correctly and you may have to set them again.

A loaded DCP can be saved as a project file. This way you can work on an already finished DCP and save intermediate steps, e.g. when modifying it.

If you want to view the DCP on an XYZ projector, you have to deactivate the automatic color conversion from X'Y'Z' to RGB of the DVS software. For this you have to alter the color spaces of the clips in the bin of the Edit Tool and set them to RGB. For further hints about how to do this see section "The Steps to Prepare a DCDM" on page 2-7.

4.3 The Menu Option 'Load KDM...'

When working on other projects on a DVS DCI Mastering system, you may want to add parts of video or audio from already created DCPs. While unencrypted DCP track files can be added without further ado, for encrypted material you have to use the menu option ***Load KDM...***. It allows you to load the keys of a self KDM into the hardware of the DCI Mastering system. Afterwards the encrypted clip can be added to the bin and you can use it in your project.

The self KDM must have been created for the DVS system where you are working on (see also section "Configurations for a Self KDM" on page 4-2).

The number of keys that can be loaded at a time is limited. A single KDM usually contains several keys (one for each track file) and up to 256 different keys can be loaded.

To use an encrypted track file in another project of the DVS software perform the following:

- On the ***Project*** menu select the menu option ***Load KDM...***.

This will open the dialog window to open a file.

- In this window select the self KDM generated for the DCP from which the track file should be used and confirm your selection with the button **OPEN**.

This will load the keys of the self KDM into the DCI Mastering system.

- Afterwards add the wanted track file (video or audio) to the bin either by using a file manager or the menu option ***Add clip*** of the bin's context menu.

This will make the encrypted track file available in the DVS software and you can use it in your project.

You can also work the other way around: First load the encrypted track file and then the self KDM.

KDM keys are not stored in a project file. Once the project is closed and opened again at a later time, you have to load the respective self KDM again to access the material of the encrypted track file.

When using this function, encrypted material may sometimes provide no thumbnails or waveforms in the DVS software. However, the video can be seen decrypted in the overlay of the Edit Tool.

4.4 Creating Additional KDMs (KDM only)

Once an already generated DCP is loaded in the Edit Tool (see section "Loading the DCP" on page 4-3), it can be used to create further KDMs, e.g. for later releases, without having to generate the DCP again. To achieve this you can use the digital cinema delivery tool with the option **KDM only** (see section "Delivery Type" on page 3-5). It will lead you straight to the configuration step where you can set up the creation of KDMs (see section "KDM" on page 3-17).

After finishing the configuration of the KDMs to be created they can be saved at any location you want in the configuration step for the delivery creation (see section "Delivery Creation" on page 4-10).

4.5 Modifying a DCP (Supplemental DCP)

An already created DCP can be modified, for example, to exchange audio, subtitles or certain parts of video. For this the digital cinema delivery tool provides the option **Supplemental DCP** (see section "Delivery Type" on page 3-5). It can be used to create different versions of a DCP, for instance, for localizations of a feature film.

A DCP made with the option **Supplemental DCP** from a master DCP generates anew only the content that was modified. For the unaltered parts of content it still requires and refers to the content of the master. In addition, a supplemental DCP will contain all the extra files that are normally included in a DCP (i.e. CPL, KDMs, PKL, etc.), and thus can be seen as a DCP of its own.

The purpose of a supplemental DCP is to minimize the time and effort to encode different versions of the same package and to reduce its overall size. All cinemas worldwide receive the same international version (master DCP) with identical reels and CPLs. Depending on the country an additional supplemental DCP is provided (normally in a subdirectory of the master DCP) containing only the relevant changes.

This section describes how to use the supplemental DCP feature of the digital cinema delivery tool.

4.5.1 Preparations

After loading an already generated DCP (see section "Loading the DCP" on page 4-3) it can be modified in the timeline of the Edit Tool. There you can change, for example, certain frames of video and the audio reels. Additionally, there may be different subtitle files available that should be included in the other version of the DCP:

The track files of a DCP should not be submitted to further rendering processes (e.g. effects on audio or video). For this use the original source project instead.

A loaded DCP can be saved as a project file. This way you can work on an already finished DCP and save intermediate steps, e.g. when modifying it.

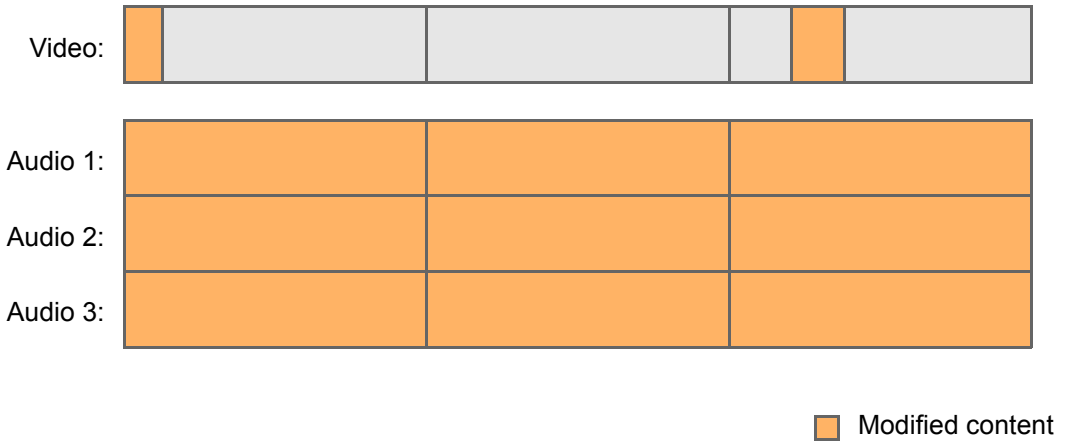


Figure 4-4: Example of a timeline with modified content

Afterwards, by using the digital cinema delivery tool with the option **Supplemental DCP** (see section "Delivery Type" on page 3-5) you can create additional supplementing content for this DCP.

4.5.2 The Configuration Steps

The configuration steps that must be performed when creating a supplemental DCP are the same as they have been made for the master DCP during its creation. Therefore, to create a supplemental DCP you can use the digital cinema delivery tool as described in chapter "Digital Cinema Delivery Tool" on page 3-1. However, because the supplemental content has to be for the most part in the same format as the master DCP, several settings items will already be set and cannot be altered.

Different subtitles can be set during the configuration step for the CPL as usual (see section "CPL" on page 3-15).

4.5.3 Reel Settings

Same as when generating a full DCP, the option to create a supplemental DCP will deal with the content reel-wise. To comprise only the changed parts of a timeline it offers you the possibility use automatically set DC reels for the creation of the additional content (see section "CPL" on page 3-15):

Figure 4-5: Reel configuration for a supplemental DCP

According to SMPTE a reel must have a duration of at least one second.

Some digital cinema players may be unable to display reels that are shorter than 5 seconds.

For further information about DC reels see section “Setting Reels” on page 2-10.

The option **Automatically set DC reels…** sets virtual DC reels for the timeline which will include only the changes. For the example timeline shown in figure 4-4 on page 4-8 this would mean reels like the following:

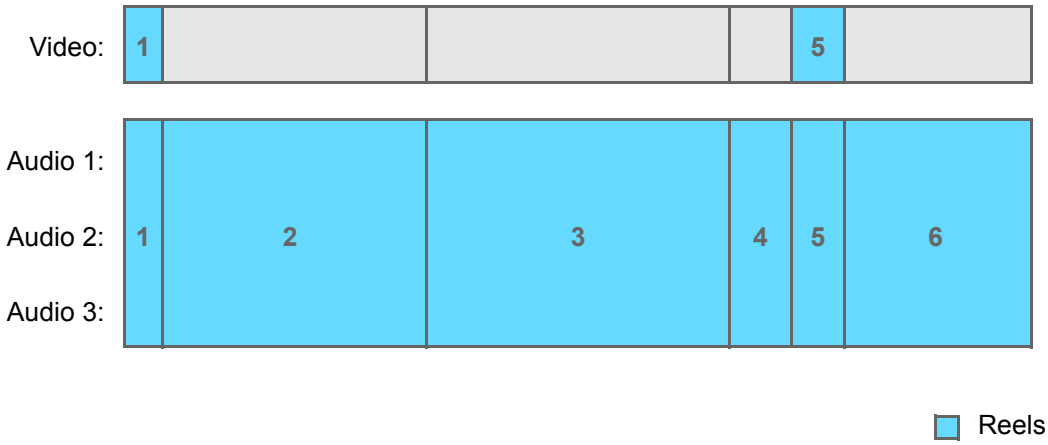


Figure 4-6: Reels to be created

Our example (see figure 4-4 on page 4-8) would create two reels for video and a whole new set of reels for the audio data. The remaining video data (parts in light grey in the figure above) would not be generated anew. During the creation process they can either be copied to the supplemental DCP or left in the master DCP. With the latter the new CPL of the supplemental DCP will reference to them. Please note that the total amount of reels increases when using automatically set DC reels and you may have to provide different subtitle files for the additional reels.

When using the option **Currently set DC reels**, the reels as currently configured for the DCP in the timeline will be used. If not manually adjusted by you in the meantime, they will be set to the reel settings of the master DCP. By configuring the DC reels in the timeline manually prior to creating a supplemental DCP, you can achieve reels according to your needs.

4.5.4 Delivery Creation

At the configuration step to specify the delivery creation the digital cinema delivery tool shows you the content that will be created (see also section “Delivery Creation” on page 3-19):

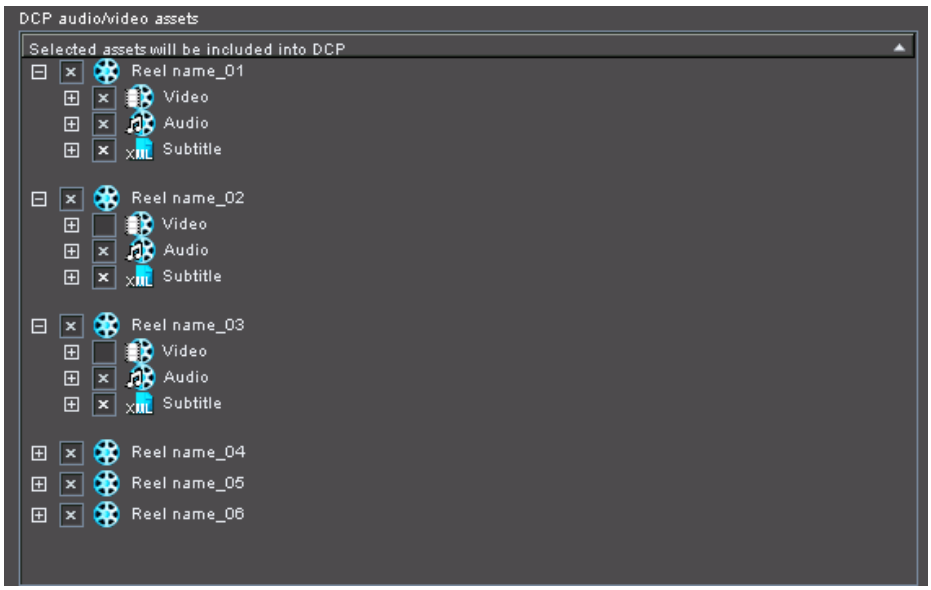


Figure 4-7: The content that will be created

When creating a supplemental DCP, the list in the area **DCP audio/video assets** indicates the reels and assets that will be generated with activated check boxes. The check boxes of assets that are mandatory for the supplemental DCP will appear dimmed and cannot be excluded from the creation process. Assets that are optional for the creation of the supplemental DCP can be deselected. By selecting check boxes that were initially deactivated, you can copy content from the master DCP to the supplemental DCP during the creation process, e.g. to create a DCP that is self-sustained and independent from the master’s content. If these assets are left deactivated, the master DCP will be needed to load the supplemental DCP.

The supplemental DCP can be created at any location you like. Anyway, when creating a supplemental DCP that requires the material of the master DCP, it should be stored in a subfolder of the master DCP. Otherwise the references of the supplemental DCP to the original material would be invalid (when loading such a supplemental DCP with the DVS software, you would be asked for their location).

After clicking on the respective button in the digital cinema delivery tool the supplemental DCP will be created according to your settings.

Stereoscopic DCP

With the DCI Mastering feature you can also create a stereoscopic DCP and thus material to be screened in 3D. This chapter describes the 3D features of CLIPSTER. First, the different types of 3D material will be described, followed by a description of how to prepare the Edit Tool for 3D depending on the type of material. After this the possibilities to work with 3D in the Edit Tool will be outlined, thereby describing, for example, how to edit and view/play out such clips. The chapter will be concluded with descriptions how to generate 3D material with the DVS system, for instance, a DCP.

5.1 Types of 3D Material

Stereoscopic material provides for each human eye a separate video stream (clip), commonly called left eye and right eye clip. They can be stored differently on a storage and the following two types of 3D material can be used in the DVS software:

– Two separate video clips (one for the left eye and one for the right eye).
– A single video clip that contains both eyes by interleaving the two video streams (interleaved video clip). This is also the native format for a stereoscopic DCP:

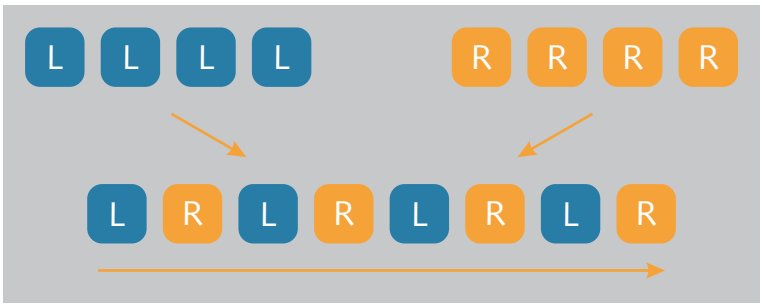


Figure 5-1: Interleaving of a 3D video clip

A stereoscopic DCP always starts with the left eye clip as the first frame.

This is also the standard mode of the DVS software: Operations (such as a finalizing or play-out) will start with the left eye clip as the first frame. However, by setting the right eye clip to be the left eye clip this behavior can be changed (see section “Merging and Unmerging Video Tracks” on page 5-7).

A clip configured as an interleaved video clip can be added to a 3D stereo track only (see section “Preparing Interleaved 3D Material” on page 5-4).

Depending on the type of material that is available to you, the DVS software has to be prepared differently (see section “Preparing the Edit Tool for 3D” on page 5-3).

5.2 Preparing the Edit Tool for 3D

Depending on the type of material that is available to you (see section "Types of 3D Material" on page 5-2) the Edit Tool has to be prepared differently to be able to work in 3D. This section describes how to prepare the different types of 3D material.

5.2.1 Preparing Two Separate Clips as 3D Material

If two separate video clips are available as your 3D material, you can add them to separate video tracks in the timeline of the Edit Tool and then merged these tracks to a single stereo track. For this perform the following:

- Add the two clips for the left and right eye to the bin, for example, by dragging them to the contents area of the bin from a file manager or by using the menu option ***Add clip*** of the bin's context menu.
- Next open the output settings of the timeline (button **SETTINGS...**).
- In the **'Timeline output settings'** window set the video track size options to show a second video track in the timeline area and confirm this with the **OK** button.
- Add the two video clips from the bin each to a video track in the timeline. It is recommended to add the left eye video clip to the first video track and the right eye video clip to the second video track.

Once this is done, the timeline of the Edit Tool will look similar to the following figure:

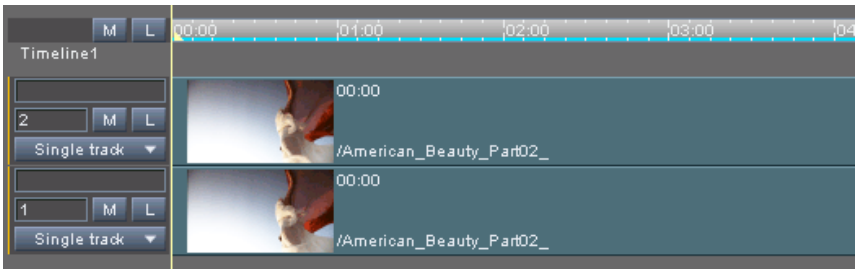


Figure 5-2: Left eye and right eye clip in the timeline

Then the two tracks can be merged to a single stereo track:

- Either perform a click on one of the items labelled **Single track** or click on the triangle to the right and select from the drop-down menu the entry ***Stereoscopic 3D track***.

After this the track properties window of the respective track will be displayed on the screen.

For further information about the track properties window and the track mode item see section "Merging and Unmerging Video Tracks" on page 5-7.

- In this window activate the radio button **Stereoscopic 3D track** and configure the tracks according to where (in which track) you have added the respective clips.
- When finished confirm your settings with the **OK** button.

This will merge the two video tracks to a single 3D stereo track in the timeline:

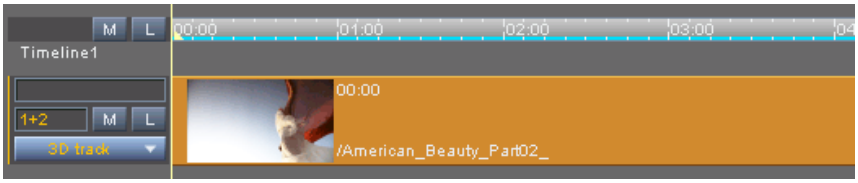


Figure 5-3: 3D stereo track in the timeline

Afterwards the preparations for two separate video clips as 3D material are finished and you can now start your work as described later in this chapter.

5.2.2 Preparing Interleaved 3D Material

When only a single video clip is available (i.e. an interleaved 3D clip), you have to alter its bin clip properties accordingly. Afterwards it can be added to a stereo track of the Edit Tool. For this perform the following:

- Add the interleaved 3D clip to the bin, for example, by dragging it to the contents area of the bin from a file manager or by using the menu option ***Add clip*** of the bin's context menu.

Afterwards the interleaved clip will be visible in the contents area of the bin. However, because an interleaved clip is registered by the DVS software just as a normal clip you have to correct its properties to account for its 3D content:

- Open the properties of the interleaved video clip in the bin (context menu of bin clip ***» Properties…***).

Then the properties window of the bin clip will be displayed on the screen.

- In this window configure the setting **Stereoscopic Clip** to `Interleaved Stereo` and confirm this with the **OK** button.

Figure 5-4: Configuring a clip to an interleaved clip

The clip will now be recognized by the DVS software as interleaved 3D material and, as a result, it can only be added to a 3D stereo track. Thus, you have to provide a 3D stereo track in the Edit Tool for it:

- Open the output settings of the timeline (button **SETTINGS...**).
- In the **'Timeline output settings'** window set the video track size options to show a second video track in the timeline area and confirm this with the **OK** button.

Once this is done, the timeline of the Edit Tool will look similar to the following figure:

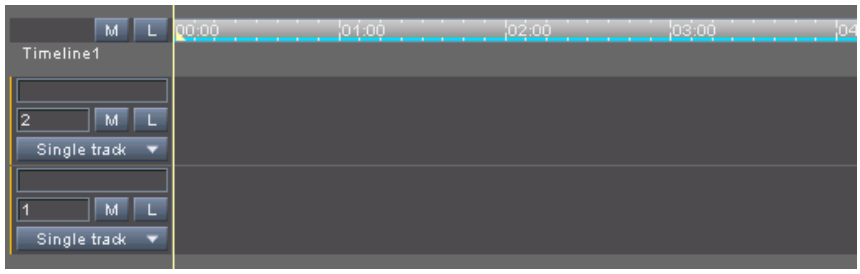


Figure 5-5: Two timeline tracks in the timeline

Then the two tracks can be merged to a single stereo track:

- Either perform a click on one of the items labelled **Single track** or click on the triangle to the right and select from the drop-down menu the entry ***Stereoscopic 3D track***.

After this the track properties window of the respective track will be displayed on the screen.

For further information about the track properties window and the track mode item see section "Merging and Unmerging Video Tracks" on page 5-7.

- In this window activate the radio button **Stereoscopic 3D track** and configure the tracks so that track 1 is set to the left eye and track 2 to the right eye.
- When finished confirm your settings with the **OK** button.

This will merge the two video tracks to a single 3D stereo track in the timeline.

- Then add the interleaved video clip from the bin to the stereo track in the timeline.

Once this is done, the timeline of the Edit Tool will look similar to the following figure:

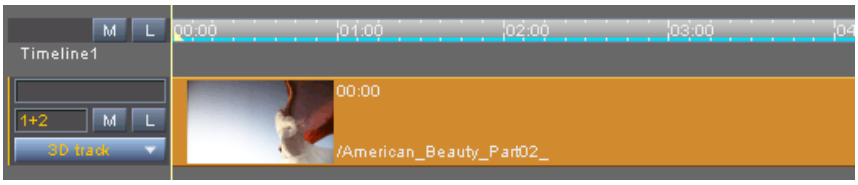


Figure 5-6: 3D stereo track in the timeline

The left eye and right eye video streams interleaved in the clip are now accessible to the DVS software. With this the preparations for an interleaved clip as 3D material are finished and you can now start your work as described later in this chapter.

5.3 Working with 3D Material

This section describes how to work with 3D material in the Edit Tool after it has been prepared and added correctly to the timeline (see section "Preparing the Edit Tool for 3D" on page 5-3). First the merging and unmerging of video tracks will be described, followed by some particulars about this. After this it will be explained how to view, edit and play out 3D clips.

5.3.1 Merging and Unmerging Video Tracks

As soon as two or more video tracks are displayed in the timeline (see also section "Preparing the Edit Tool for 3D" on page 5-3), video tracks can be merged as well as unmerged. For this you have to use the track mode item right in front of a video track:

Please observe also section "Particulars about Merging and Unmerging" on page 5-8.

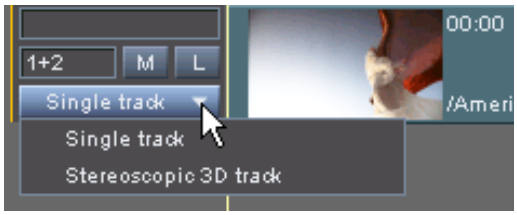


Figure 5-7: The track mode item

When clicking on the triangle to the right on the track mode item, a drop-down menu will be displayed that can be used to configure the tracks:

Single track	Configures the respective track to a standard single video track of the Edit Tool. If a 3D track already, it will be unmerged to two single tracks again, each holding the left eye/right eye clip. When unmerging a track containing an interleaved 3D clip, it will also be split into two separate clips.
Stereoscopic 3D track	Configures the respective track (and its partner track, if it was a 3D track previously) to a 3D stereo track again. If the respective track was not a 3D track before, the properties window of the respective track will be opened (see below).

A direct click on the track mode item always opens the properties window of the respective track:

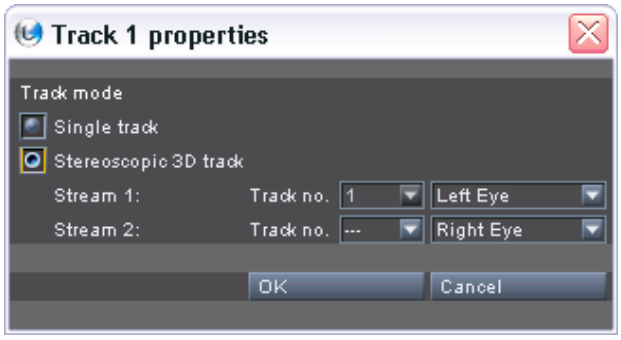


Figure 5-8: The track properties window

The track properties window provides the following settings items:

Single track	Same as the option ***Single track*** of the drop-down menu above.
Stereoscopic 3D track	When this option is activated, the tracks as indicated by the items **Stream 1** and **Stream 2** will be configured to a 3D stereo track. Select the partner track of the first stream (i.e. of the track where the properties window has been invoked) with the **Track no.** combo box of **Stream 2**. With the combo boxes to the right you have to determine which of the tracks contains the left and the right eye clip.

The DVS software starts an operation for 3D (such as a finalizing or play-out) with the left eye clip as the first frame. However, by configuring the track of the right eye clip to `Left Eye` this behavior can be changed.

Once everything is set correctly, you can confirm your settings by clicking the **OK** button. The **CANCEL** button will close the properties window without altering the states of the track(s).

5.3.2 Particulars about Merging and Unmerging

There are several particulars that are worth to note when merging and unmerging video tracks:

Automatic Activation of Stereoscopic Output Mode

When video tracks are merged to a 3D stereo track, the stereoscopic output mode is automatically activated (button **SETTINGS...** of the

timeline area, see section “Configuring the Output” on page 5-12) and it will remain activated for this project if not deactivated manually.

Interleaved Video Clips

A clip configured as an interleaved video clip can be added to a 3D stereo track only (see section “Preparing Interleaved 3D Material” on page 5-4). Its two streams are then accessible to the DVS software. By unmerging a stereo track containing an interleaved video clip, the two streams can be accessed separately as two individual clips, one for the left and one for the right eye.

Track Numbers

The (first) number in front of a video track indicates the track number. If a second number is displayed with a plus sign in front, it details the respective partner track of this track (either if currently a 3D track or previously configured to one): `<track no.>+<partner track no.>`.

Synchronicity

When merging two video tracks to a 3D stereo track, the edit points of the timeline elements in both tracks must coincide, i.e. the timeline elements must be synchronous. If they are not synchronous, you will be informed about this and the respective elements will be particularly highlighted in the timeline area:

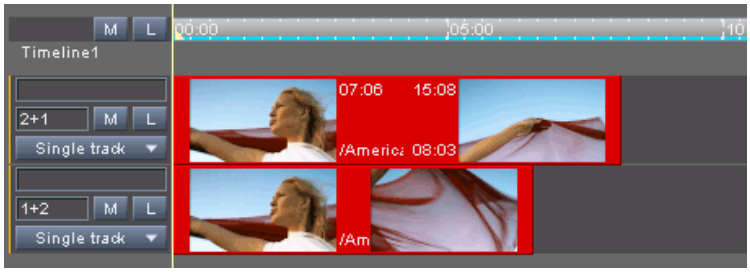


Figure 5-9: Error marked clips in the timeline area

To reset the highlighting you can resolve the cause for this error and then merge the two tracks, or call the context menu of a video clip in the timeline and select the menu option ***Reset error status***. Afterwards the clips will be displayed with their normal color again.

No Partner Element

The complementary partner element of a left/right eye clip pair can be left out from the timeline, meaning timeline stretches on one of the tracks to be merged to a 3D track can be left empty. Those tracks can

still be merged to a 3D stereo track, as long as synchronicity is observed everywhere else in the timeline (see above). Then the timeline element without a partner will be duplicated and added to the empty track. When unmerging the track again, you will find instead of just one timeline element identical timeline elements in both tracks.

5.3.3 Editing

Once 3D material is properly prepared and available in the timeline of the Edit Tool (see section "Preparing the Edit Tool for 3D" on page 5-3), you can start to work with it.

Any stereo track available in the timeline area of the Edit Tool can be edited the same way as a standard single video track. The timeline elements on 3D stereo tracks can be, for example, cut or trimmed, or transitions and effects can be applied. All editing work will be applied to both streams at the same time.

When merging two video tracks with different effects applied to the timeline elements, the effects operators will be copied from the elements of the first stream to the elements of the second stream. The ones of the second stream will be deleted.

5.3.4 Viewing and Playing Out

With 3D material prepared and available in the timeline (see section "Preparing the Edit Tool for 3D" on page 5-3) you can start to work with it. This can be easily controlled via the video overlay or a monitor connected to the outputs of the DVS system. For example, an anaglyph emulation mode allows you to control the 3D depth of the material on the fly in the video overlay, and afterwards it can be played out in all common 3D methods.

The material that will be displayed in the video overlay and at the outputs can be configured with the output mode and left eye/right eye combo boxes.

These items will be available when the stereoscopic output mode is activated (see section "Configuring the Output" on page 5-12) and/or video tracks are merged to a 3D stereo track in the timeline.

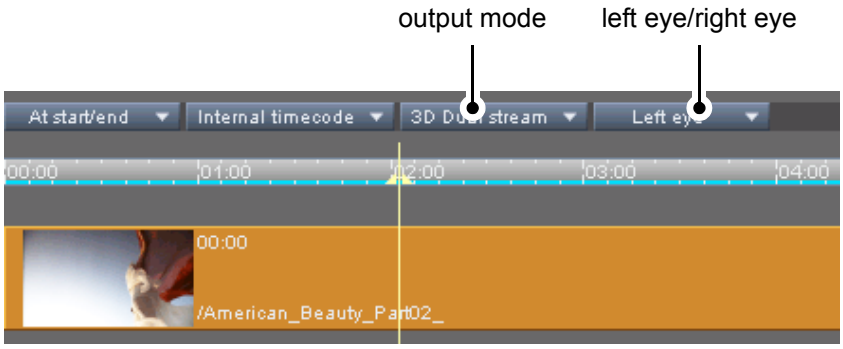


Figure 5-10: 3D items in the timeline area

Furthermore, the stereoscopic output mode and the output ports can be configured with the timeline output settings. All these items are described in the following.

Output Mode Combo Box

With the output mode combo box you determine what will be displayed in the video overlay and at the outputs of the system. After selecting it a drop-down list will be displayed on the screen offering you the following options:

Single stream	When this option is selected, the 3D track in the timeline will be displayed as if it were a standard single video track. The video overlay as well as the outputs show all one stream of the 3D track only. You can select the stream that should be displayed with the left eye/right eye combo box.
3D Dual stream	This option displays the two streams of the 3D track independently at two different output ports of the system. The output ports can be configured with the timeline output settings (see section “Configuring the Output” on page 5-12). With this the video overlay shows a single stream only, i.e. the one selected via the left eye/right eye combo box.
3D Anaglyph red/ cyan stream	Combines the two streams of the 3D track to a single anaglyph stream for red/cyan glasses and displays it in the video overlay as well as at the outputs of the system. To activate it select one of the saturations (0 or 100 %) for the color of the 3D material with the submenu of this option.

3D Anaglyph red/ green stream	Same as ***3D Anaglyph red/cyan stream***, but the anaglyph stream is for red/green glasses.
3D Single stream	Combines the two streams of the 3D track to a single stream and displays it in the video overlay as well as at the system's outputs (e.g. for special 3D displays). For this you have to select the way the streams will be combined with the submenu of this option. You can choose between displaying the two images side by side (left/right or top/bottom) or interlaced.

Left Eye/Right Eye Combo Box

The left eye/right eye combo box determines what to display in the user interface of the DVS software. With it you can select, depending on the setting of the output mode combo box, which of the streams to view in the video overlay. Additionally, it controls whether the left eye or right eye stream should be displayed by the representations of the video clips in the 3D track, e.g. via their thumbnails.

Furthermore, in the **Single stream** output mode it effects the signal displayed at the output ports of the DVS system.

Configuring the Output

Via the **SETTINGS...** button you can set up and configure the output of stereoscopic material as well as the output ports that should be used for this. It is located at the top left side of the timeline area.

After pressing this button the **'Timeline output settings'** window will be displayed on the screen. At the bottom of this window you can find the **Options** area where further optional settings are provided. To the right you can find the settings items for a configuration of the stereoscopic output.

Figure 5-11: Configuring the stereoscopic output

With the check box of the **Stereoscopic output** settings you can turn on or off the stereoscopic output mode of the DVS system. It will be automatically activated when tracks are merged to a 3D stereo track in the timeline. When deactivated manually, a single stream of a 3D track will be shown in the video overlay as well as at the outputs of the DVS system only (same as the setting ***Single stream*** of the output mode combo box, see section "Output Mode Combo Box" on page 5-11).

By clicking the button **3D OUTPUT PORTS...** the HD-SDI output ports of the DVS system can be configured. It opens the following window:

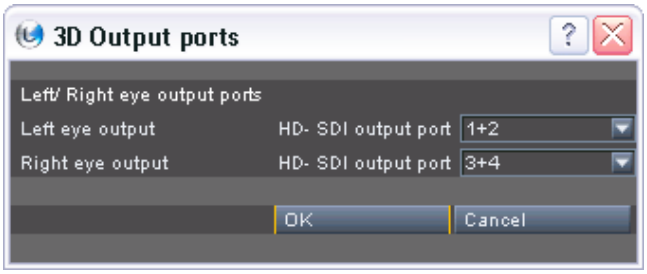


Figure 5-12: Configuring the output ports

In this window you determine on which of the HD-SDI output ports of the DVS system to give out the left eye and right eye stream of a 3D stereo track in the timeline when the output mode combo box is set to ***3D Dual stream*** (see section "Output Mode Combo Box" on page 5-11).

Once everything is set as desired, the configuration of the stereoscopic output is complete and you can view the 3D material as configured via the HD-SDI outputs of the DVS system.

5.4 Generating 3D Material

In this section it is explained how to generate 3D material with the DVS system and its software. First it will be explained how to create a DCP with stereoscopic content. After this it is described how to finalize a project in 3D, followed by a description of the possibility to record material in 3D.

5.4.1 Creating a 3D DCP

This section explains how to create a DCP with stereoscopic content via the digital cinema delivery tool. For this you have to follow the instructions as given in this manual and …

- … create and prepare your project as described in chapter "Getting Started" on page 2-1.
- … configure the video tracks of your project to 3D stereo tracks (see this chapter, e.g. section "Preparing the Edit Tool for 3D" on page 5-3).

After this you can start the creation of the DCP as described in chapter "Digital Cinema Delivery Tool" on page 3-1.

For the creation of a stereoscopic DCP there is the **Stereoscopic output** setting available in the digital cinema delivery tool. It can be found in the settings pane of the delivery format configuration step (see section "Delivery Format" on page 3-11):

Figure 5-13: Configuring the stereoscopic output for a DCP

To create a stereoscopic DCP the check box of the **Stereoscopic output** setting must be activated. With the combo box to the right you can then configure the output type of the 3D DCP. Because there is only one type allowed for such a DCP, it is automatically set and no other type can be selected here (see also section "Types of 3D Material" on page 5-2). With this activated the DCP will be created as a stereoscopic DCP.

At the delivery creation configuration step the digital cinema delivery tool will show you for the video assets the sources of the left and right eye clips separately, thereby allowing you to confirm the contents of the 3D DCP (see also section "Delivery Creation" on page 3-19):

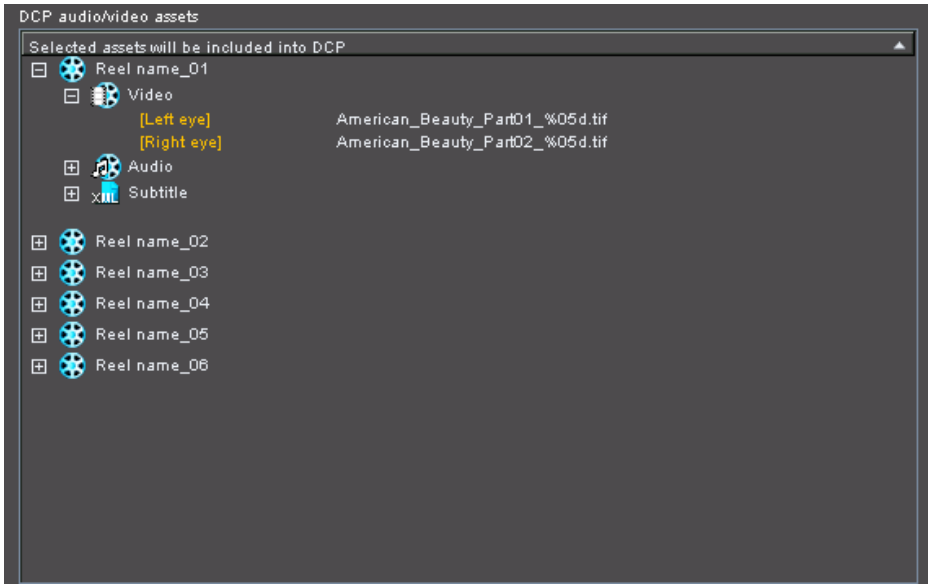


Figure 5-14: The assets of a 3D DCP

After clicking on the respective button in the digital cinema delivery tool the stereoscopic DCP will be created according to your settings.

A stereoscopic DCP can be loaded in the DVS software as described in chapter "Using the DCP and Self KDM" on page 4-1. The video track will be automatically configured to a 3D stereo track.

5.4.2 Finalizing 3D Material

3D material can also be created via a finalizing, for example, to create digital cinema content manually (see chapter "Manual Creation of a DCP" on page 6-1). For this your content must be appropriately prepared with the video data in 3D stereo tracks (see this chapter, e.g. section "Preparing the Edit Tool for 3D" on page 5-3). Then it can be finalized in 3D.

In the finalize dialog you can find among the optional items for a video output the setting **Stereoscopic output**:

Figure 5-15: Configuring the stereoscopic output for a finalizing

To create stereoscopic content via finalizing the check box of the **Stereoscopic output** setting must be activated. With the combo box to

the right you can then configure the output format of the 3D material. The following settings are available:

`Interleaved stream`	The 3D stereo track will be finalized into an interleaved clip (see section “Types of 3D Material” on page 5-2).
`Dual stream`	Two separate clips, one for the left eye and one for the right eye, will be created.
`Anaglyph R/C stream...`	The two streams of the 3D track will be combined to a single anaglyph stream for red/cyan glasses and then finalized to a clip. There are two settings available for this that can be used to select the saturation of the images' colors (0 or 100 %).
`Anaglyph R/G stream...`	Same as `Anaglyph R/C stream...`, but the anaglyph stream is for red/green glasses.

With the **Stereoscopic output** setting activated the material will be finalized according to your configurations once the finalizing is initialized.

5.4.3 Recording 3D Material

With the DVS software you can also capture 3D material. This has to be performed in the I/O Tool software module of the DVS software. When configuring the input format, you can find sorted under the video format type 'Other' (button **OTHER**) several rasters tagged with 'STEREO' in the column 'Group':

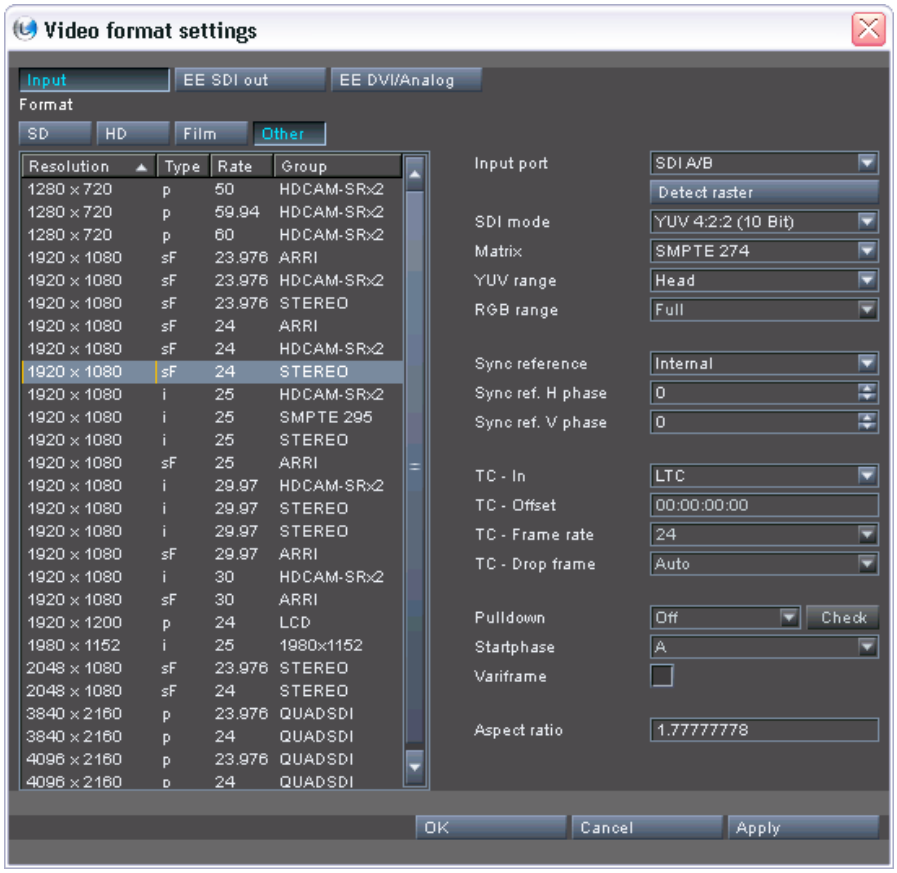


Figure 5-16: Configuring an input

These video rasters can be used to record a 3D dual stream. The two streams must be available in YUV at one of the dual-link HD-SDI input ports of the DVS system (e.g. ports A/B). Then during capturing, the two streams will be written into an interleaved clip (see section “Types of 3D Material” on page 5-2) according to your settings for the input.

Manual Creation of a DCP

Every state towards a DCP or the final DCP itself can also be created manually by using the finalizing dialog of the DVS software. This way to create digital cinema material is not as intuitive and forthcoming as the digital cinema delivery tool (see chapter “Digital Cinema Delivery Tool” on page 3-1), but it is to some extent more flexible regarding the created output. With it you can, for example, create MPEG compressed DCPs (MPEG Interop, see section “DCP Standards” on page 2-6).

This section describes how to create digital cinema material manually via finalizing(s), i.e. the following will be explained:

1. How to create a DCDM from a DSM, i.e. a sequence of TIFF image files in 16 bit X′Y′Z′ (see also section “Digital Cinema Distribution Master (DCDM)” on page 2-3).
2. How to create JPEG2000 compressed data optimized for the digital cinema either from a DSM or DCDM, i.e. a sequence of JPEG2000 files in 12 bit X′Y′Z′ (see also section “JPEG2000” on page 2-3).
3. How to create a DCP either unencrypted (e.g. for trailers or advertisements) or encrypted (e.g. for a feature film) from a DSM, a DCDM or digital cinema compliant JPEG2000 data (see also section “Digital Cinema Package (DCP)” on page 2-4).

Additionally, it will be described how use the finalizing dialog to create additional KDMs, e.g. for later releases, or to modify a DCP manually.

6.1 Creating a DCDM Manually

This section describes how to create a DCDM from a DSM. For further information about this delivery type see section "Digital Cinema Distribution Master (DCDM)" on page 2-3:

For some particulars about the creation of a DCDM see section "Color Space Conversions" on page 7-2.

- Prepare the DSM as described in section "The Steps to Prepare a DSM" on page 2-7.
- Afterwards call up the finalize dialog of the DVS software (menu ***Project » Finalize...***).
- Choose a name and storage location for the finalized files according to your project's needs. To set the file name(s) you can also use a variable naming with the button **NAME OPTIONS...**.

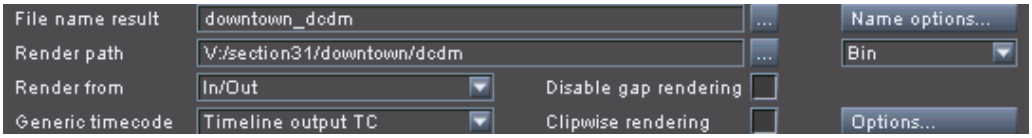


Figure 6-1: File name and storage location

- As the file format select the TIFF file format with the saving type `16 bit RGB big endian`.
- Make sure that the hardware finalize support is activated.

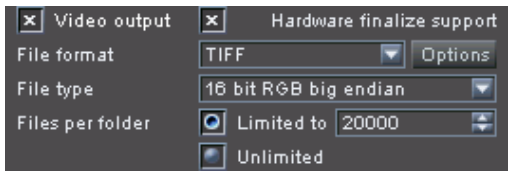


Figure 6-2: File format settings

As specified by SMPTE/DCI the DCDM has to be saved in X'Y'Z' in the TIFF file format. However, the TIFF file format natively does not store the X'Y'Z' color space: It saves the RGB or Luma color space only. To make this work nevertheless, a 3D look-up table (LUT) has to be applied to the DSM material which will then create the X'Y'Z' color space compliant with the specifications:

- To convert the DSM to X'Y'Z' select the 3D LUT appropriate for your project's material with the button **3D LUT...** (

). For this you may use one of the available 3D LUTs provided by DVS.

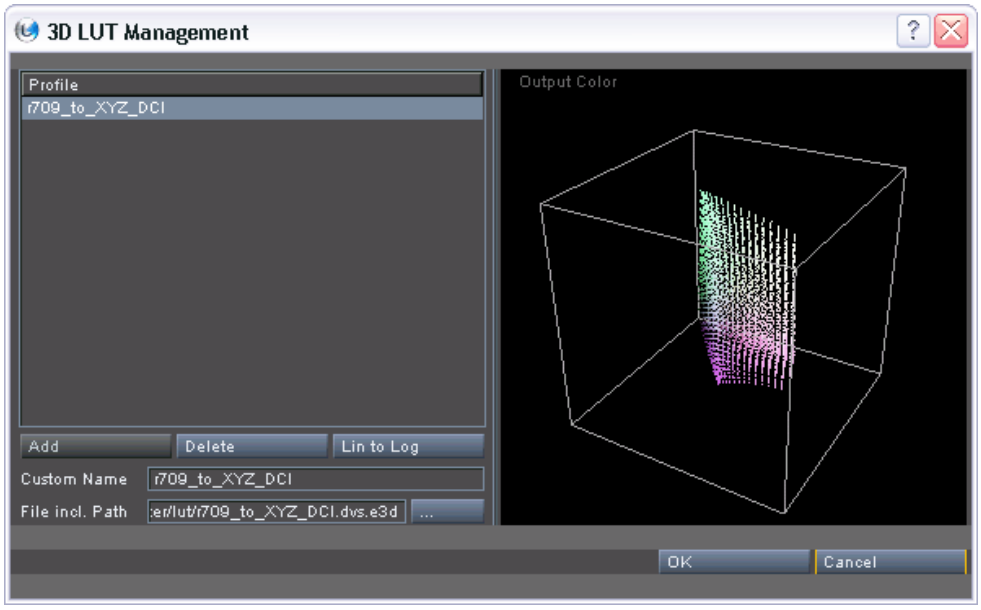


Figure 6-3: Window to select a 3D LUT file

- After the selection and when returned to the finalize dialog, make sure that the check box in front of the **3D LUT...** button is activated, otherwise the 3D LUT will not be applied and no color space conversion to X'Y'Z' takes place.
- Use the buttons, the list box and the settings items in the middle of the finalize dialog to specify the video format. Adjust them so that they match the format of the final DCP (see section "Possible Formats for a DCI Mastering" on page 2-4).
- Specify the audio format for the digital cinema content according to your project's needs, for example, select the WAV file format in 24 bit as a multi-channel file.

Figure 6-4: Audio settings

After this the settings to create a DCDM are complete and you can start the finalize process at any time:

- Press the button **RENDER** to start the generation of the DCDM.

This will start the finalizing of the DCDM and it will be created at the specified location.

6.2 Creating JPEG2000 D-Cinema Data Manually

This section describes how to create JPEG2000 compressed data optimized for the digital cinema either from a DSM or DCDM. For further information about this delivery type see section "JPEG2000" on page 2-3:

- Prepare your source data (either a DSM or a DCDM) appropriately as described in section "Preparing the Source Data" on page 2-7.
- Afterwards call up the finalize dialog of the DVS software (menu ***Project » Finalize…***).
- Choose a name and storage location for the finalized files according to your project's needs. To set the file name(s) you can also use a variable naming with the button **NAME OPTIONS…**.

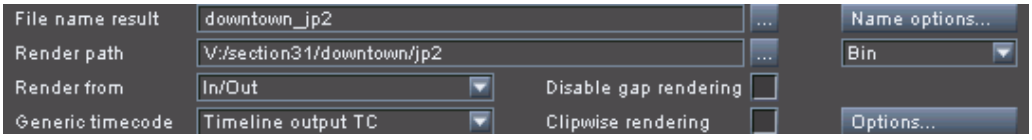


Figure 6-5: File name and storage location

- As the file format select the JP2 file format with the saving type `12 bit XYZ`.
- Configure the JPEG2000 encoding options as described in section "JPEG2000 Options" on page 7-6.
- Make sure that the hardware finalize support is activated.

Figure 6-6: File format settings

- Use the buttons, the list box and the settings items in the middle of the finalize dialog to specify the video format. Adjust them so that they match the format of the final DCP (see section "Possible Formats for a DCI Mastering" on page 2-4).
- Specify the audio format for the digital cinema content according to your project's needs, for example, select the WAV file format in 24 bit as a multi-channel file.

Figure 6-7: Audio settings

After this the settings to create JPEG2000 encoded digital cinema content are complete and you can start the finalize process at any time:

- Press the button **RENDER** to start the generation of the JPEG2000 data.

This will start the finalizing process and the JPEG2000 data will be created at the specified location.

6.3 Creating a DCP Manually

This section describes how to create a DCP either unencrypted (e.g. for trailers or advertisements) or encrypted (e.g. for a feature film) from a DSM, a DCDM or digital cinema compliant JPEG2000 data. For further information about this see section "Digital Cinema Package (DCP)" on page 2-4:

To create a DCP the source data has to be prepared first as described in chapter "Getting Started" on page 2-1, i.e. it has to be prepared and reels as well as the general configurations have to be made. Afterwards the finalizing has to be configured and as the final step the project has to be rendered which will result in the final DCP. These last two steps are described in this section.

6.3.1 Finalize Settings – Naming and Storage Options

With the project properly prepared for the creation of the DCP (see chapter "Getting Started" on page 2-1) you can begin to set up the DCP finalizing:

- Call up the finalize dialog of the DVS software (menu ***Project » Finalize...***).
- Next choose a name and storage location for the finalized files according to your project's needs. To set the file name(s) you can also use a variable naming with the button **NAME OPTIONS...**.

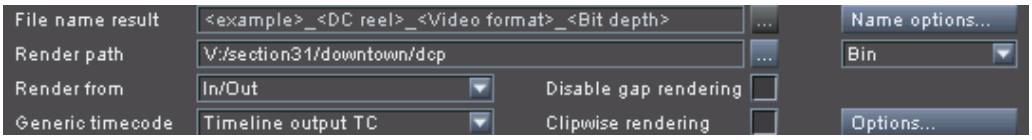


Figure 6-8: File name and storage location

With this the file naming and storage location are determined. Next you have to continue with section "Finalize Settings – File and Video Format" on page 6-6 and set the video format for the DCP.

6.3.2 Finalize Settings – File and Video Format

In this step you have to configure the file and video format of the DCP:

- If not already set select `DC MXF` as the file format.

This will automatically set the saving/file type to `12 bit XYZ` and the audio file format to `DC MXF`.

To create a DCP according to the standard MPEG Interop you have to select `MPEG2 VES` as the saving/file type. Furthermore, for this the setting **SMPTE Phase 1** (see section "Configuring the System for a DCP Creation" on page 2-17) must be deactivated. See also section "DCP Standards" on page 2-6.

- Configure the JPEG2000 encoding options as described in section "JPEG2000 Options" on page 7-6.

When creating an MPEG Interop DCP, it can also be configured further same way as the JPEG2000 options.

- Make sure that the hardware finalize support is activated.
- Use the buttons, the list box and the settings items in the middle of the finalize dialog to specify the video format. If not already set correctly adjust them to the format that the final DCP should provide (see also section "Possible Formats for a DCI Mastering" on page 2-4).

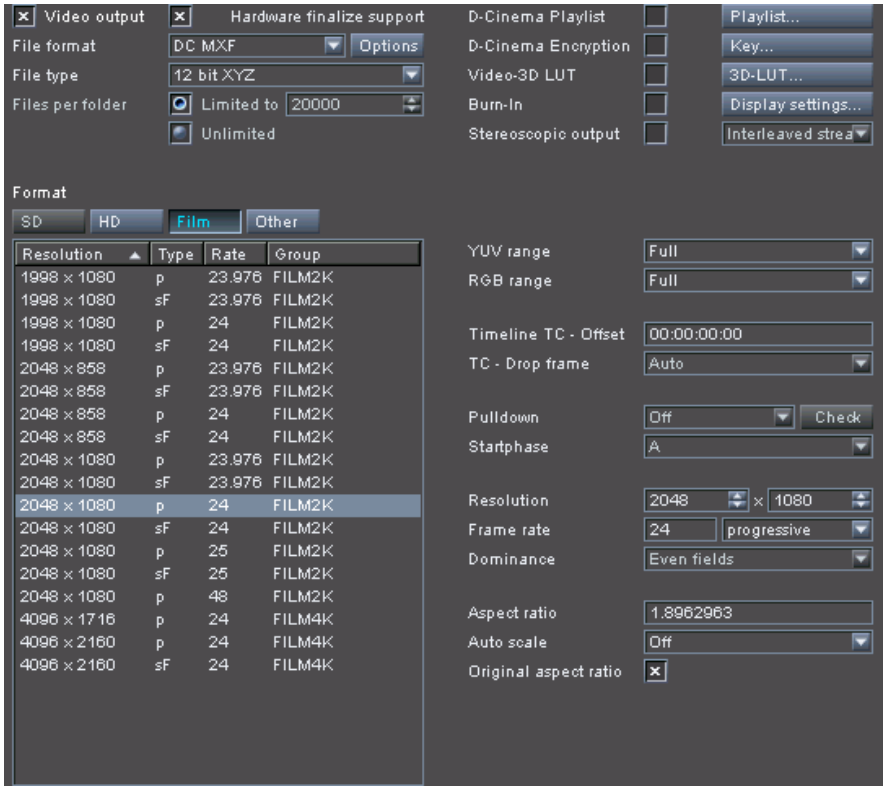


Figure 6-9: Video format settings

With this the file and video format are set properly and you can continue the configuration of the finalizing by setting up the CPL (see section "Finalize Settings – CPL" on page 6-8).

6.3.3 Finalize Settings – CPL

When finalizing to a DCP you also have to generate a Composition Playlist (CPL).

The items for a CPL will be available only when in at least one activated finalize output `DC MXF` is selected as the file format.

- To activate the generation of a CPL enable the check box **D-Cinema Playlist** in the finalize window.

This will be enough to generate a CPL when the DCP is finalized.

However, there is also the possibility to configure the CPL. For this perform the following:

- Click on the **PLAYLIST...** button.

This will open the window to configure the CPL:

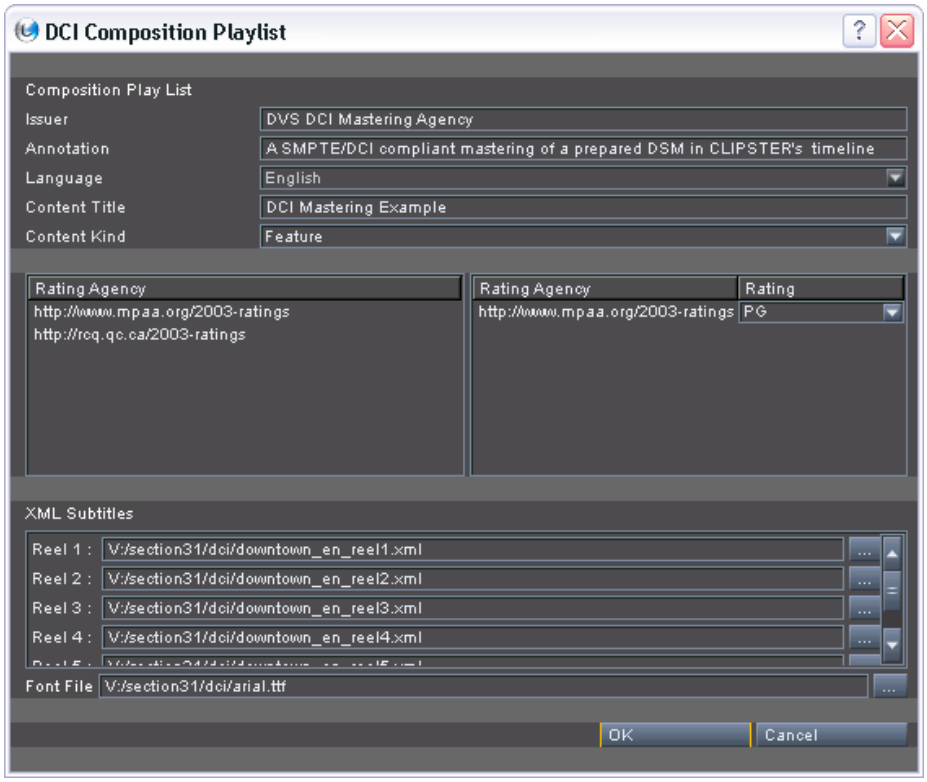


Figure 6-10: CPL configuration

- Configure the settings according to your requirements.

  These settings items are identical to the ones used in the digital cinema delivery tool. For further information about them see section "CPL" on page 3-15

- When everything is set as desired click the **OK** button.

This will close the window to configure the CPL and you will be returned to the finalize dialog.

With the check box in front of the **PLAYLIST...** button activated, the CPL will be generated during the finalizing of the DCP. As the next step the creation of the KDMs must be configured (see section "Finalize Settings – KDM" on page 6-9).

6.3.4 Finalize Settings – KDM

For an encrypted DCP one or more KDMs have to be created as well. Usually you will create one KDM for each D-Cinema player that should play out the content and for this the public key of the D-Cinema player is required. The generation of the KDMs as well as the keys that should be used can be configured with the items **D-Cinema Encryption**.

The items for a KDM will be available only when in at least one activated finalize output `DC MXF` is selected as the file format.

To create an unencrypted DCP see that the check box in front of the **KEY...** button is deactivated.

To configure the generation of the KDM(s) perform the following:

- Click on the **KEY...** button.

This will open the window to configure the KDM generation:

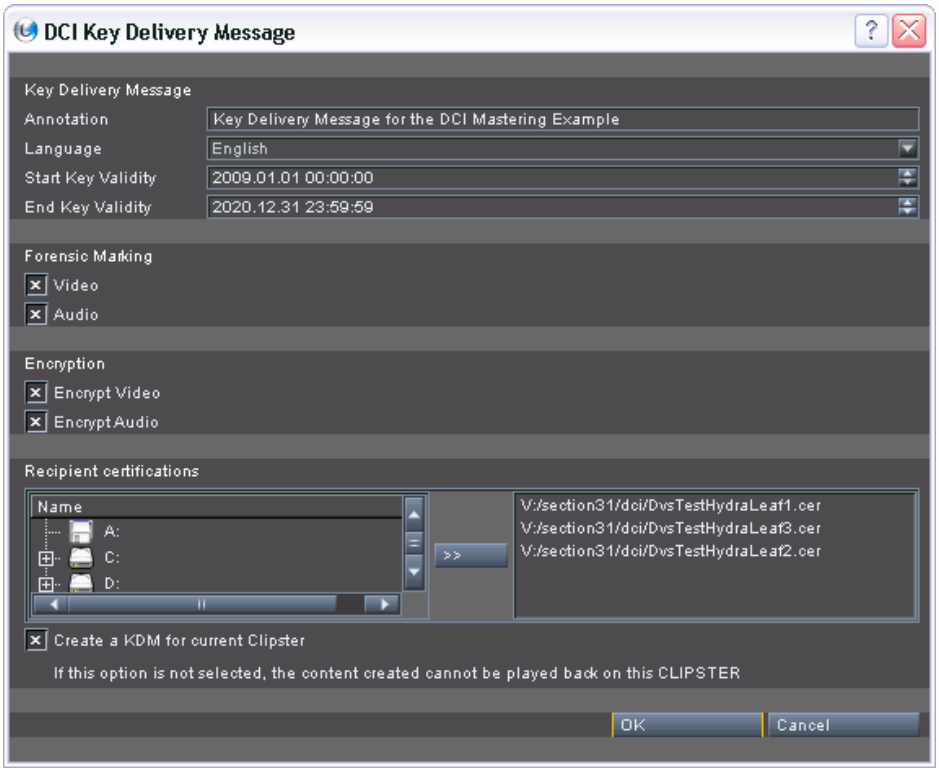


Figure 6-11: KDM generation configuration

- In this window set the generation of the KDM(s) according to your needs.

  These settings items are identical to the ones used in the digital cinema delivery tool. For further information about them see section “KDM” on page 3-17

- When everything is set as desired click the **OK** button.

This will close the window to configure the KDM(s) and you will be returned to the finalize dialog.

- In the finalize dialog make sure that the check box in front of the **KEY...** button is activated, otherwise an encryption will not be made and KDM(s) will not be created.

With this the KDM(s) will be created during the finalizing and you can continue the configuration of the finalizing by finishing it (see section “Further Finalize Settings and Rendering” on page 6-10).

6.3.5 Further Finalize Settings and Rendering

Now only the audio settings remain to be set:

- If necessary enable the output of audio.
- In case it is not already set select `DC MXF` as the file format.

This will automatically configure the fields **Bit depth** and **Render audio in** to the correct settings for a DCP.

- Use the remaining settings items to configure the audio output to the needs of your DCP (see also section “Delivery Format” on page 3-11).

Figure 6-12: Audio format settings

After this the settings to create a DCP should be complete and you can start the finalize process at any time:

- Press the button **RENDER** to start the generation of the DCP.

This will start the finalizing and the files of the DCP will be created at the specified location as described in section “The Generated Files” on page 3-21. Once these are available you have successfully created a compliant DCP with the DVS software that is ready for distribution.

6.4 Creating Additional KDMs Manually

With an already encrypted DCP and a self KDM you are able to create further KDMs, for example, for later releases of the same material without having to generate the DCP again. For this perform the following:

- Load the encrypted DCP as described in section "Loading the DCP" on page 4-3.
- Then call up the finalize dialog of the DVS software (menu ***Project » Finalize…***).
- Next choose a name and storage location for the KDM(s).

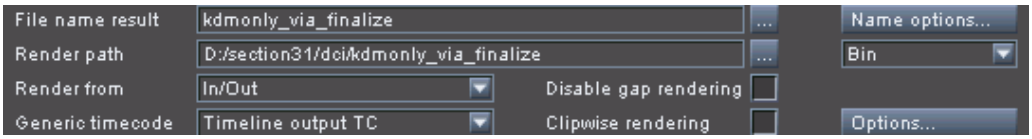


Figure 6-13: File name and storage location

- Activate the finalizing of video with the check box **Video output**.

With a DCP loaded via a self KDM, you will get in the list of file formats (combo box **File format**) an additional entry named `DC KDM`.

- As the file format select `DC KDM`.
- Afterwards click on the **KEY…** button.

This will open the window to configure the KDM generation (see section "Finalize Settings – KDM" on page 6-9).

- In this window configure the generation of the additional KDM(s) (see section "KDM" on page 3-17). However, because a self KDM for the current DCP is already available, you may deactivate the check box **Create a KDM for current Clipster**.
- When everything is set as desired click the **OK** button.

This will close the window to configure the KDM(s) and you will be returned to the finalize dialog.

- In the finalize dialog make sure that the check box in front of the **KEY…** button is activated, otherwise the KDM(s) will not be created.

After this the settings to create additional KDM(s) are finished and you can start their creation at any time:

- Press the button **RENDER** to start the creation of the additional KDM(s).

This will start the creation and the additional KDM(s) will be written to the specified location.

6.5 Modifying a DCP Manually

An already created DCP can be used to modify its content, for example, to exchange audio or subtitles, or for a later encryption of the content. With this you are able to create different versions of the same DCP without having to generate it again completely (i.e. unaltered track files will not be rendered again but copied).

This approach to modify a DCP creates a complete DCP from the master DCP. To create a supplemental DCP you have to use the digital cinema delivery tool (see section “Modifying a DCP (Supplemental DCP)” on page 4-7).

The track files of a DCP should not be submitted to further rendering processes (e.g. effects on audio or video). For this use the original source project instead.

To modify a DCP perform the following:

- Load the DCP as described in section “Loading the DCP” on page 4-3.
- If required replace video/audio track files in the timeline.

When using the finalize dialog to modify a DCP, modifications to track files are observed reel-wise only: For example, even if only one frame of video is changed, this reel will be rendered again completely. However, by changing the DC reels in the timeline area similar to the automatically created ones as described in section “Reel Settings” on page 4-8 additional renderings can be avoided.

- If required adapt the DC reels in the timeline (see section “Setting Reels” on page 2-10).
- Then call up the finalize dialog of the DVS software (menu ***Project » Finalize…***).
- In the finalize dialog adjust all settings including the ones for CPL and KDMs so that they match the master DCP (see section “Creating a DCP Manually” on page 6-6), except the following ones:
  - You may select another file name for the finalized files. After the generation only the newly generated files will carry this name.
  - As a storage location choose a different directory.
  - If required select in the dialog window to configure the CPL (button **PLAYLIST…**) other subtitle files.
  - If required adjust the encryption or KDMs to be created in the dialog window to configure the KDMs (button **KEY…**).

If track files have been modified, you will need another self KDM to be able to load them with the DVS software.

Once the settings are made you can start the generation of the modified DCP at any time:

- Press the button **RENDER** to start the modification of the DCP.

This will start the modification of the DCP: Altered or newly added track files will be generated and wrapped in MXF, whereas all unchanged files will be copied to the location specified for the DCP. Additionally, the extra files (i.e. CPL, KDMs and PKL) will be created as well.

Miscellaneous

This chapter explains other DCP related topics, such as some particulars about color space conversions or how to adapt the rating agencies. Furthermore, some background information about keys and certificates are provided.

7.1 Color Space Conversions

According to the specifications a DCDM/DCP should be converted and saved in the X'Y'Z' color space. The most important concept about a color space conversion is, that you should know the source material that you want to process. The properties of the clips added to the bin and used in the timeline (context menu of bin clip ***» Properties…***) must reflect these, i.e. they have to match the properties of the material on the storage. For any correct color space conversion when performing a DCI Mastering, the timeline of the Edit Tool should consist of clips in a single color space only.

Furthermore, when using the digital cinema delivery tool or manually finalizing to digital cinema content, the color space of your material in the timeline has to be specified further by choosing the correct color profile (color type) for the source material in the timeline. With the digital cinema delivery tool it can be set in the second configuration step (see section "Source Type" on page 3-9). When converting to digital cinema content manually, it can be found under the JPEG2000 encoding parameters (see section "JPEG2000 Options" on page 7-6). This way the DVS software will know how to interpret the color space of your video material in the timeline.

Once these two settings (i.e. the bin clip properties and the color profile) are set properly, the color space conversion(s) will be performed correctly during the creation of the digital cinema content.

Particulars for a DCDM Conversion

The color space conversion for a DCDM is performed via a 3D look-up table (LUT).

When using the digital cinema delivery tool, you can choose between predefined 3D LUTs or a LUT of your own (see section "Source Type" on page 3-9). A predefined 3D LUT can be selected by choosing one of the color profiles/types detailed in the source type configuration step.

With this, a 3D LUT that has been applied to the timeline already (i.e. via the output settings) will be overwritten.

To use a 3D LUT of your own it must be applied to the timeline the usual way. Then, with the appropriate option selected in the digital cinema delivery tool, it will be used for the DCDM conversion.

When converting to a DCDM manually, you have to select the 3D LUT that should be applied to the DSM material in the finalize dialog (see section "Creating a DCDM Manually" on page 6-2). DVS delivers several predefined LUT files together with the DVS software that may be suitable for the color space conversion. This way you can also apply a 3D LUT of your own.

Particulars for All Other Delivery Types

Contrary to a DCDM conversion, when converting material to a delivery type where a JPEG2000 encoding is involved (i.e. all other delivery types but a DCDM), the color space conversion is performed via a matrix. This way provides the best possible color space conversion.

Furthermore, a 3D LUT that is applied to the timeline will be evaluated during the conversion as well (regardless of whether the digital cinema delivery tool is used or the conversion is made manually). The only exception from this is when you use in the digital cinema delivery tool a 3D LUT of your own to effect the color space conversion to X'Y'Z' (see section "Source Type" on page 3-9). Then, only this one will be used for the conversion.

7.2 Adapting the Rating Agencies

During the configuration of the CPL (see section “CPL” on page 3-15 and section “Finalize Settings – CPL” on page 6-8) you can set one or more rating agencies. Ex factory the software already offers a few rating agencies. However, these may not be enough for your work. Then you can add new selectable rating agencies or edit the already available ones.

The file *RatingAgency.xml* in the program installation directory of the DVS software (usually *C:\Program Files\DVS\Clipster*) contains the rating agencies that will be displayed in the Edit Tool. It is a file in XML syntax that can be adapted to your needs: Just copy, paste and edit the entries and afterwards save the file. The adaptations will be displayed in the software when configuring a CPL creation.

The name of the agency (attribute NAME of the <AGENCY> tag) should contain a URI that uniquely identifies the agency which issued the ratings.

The following shows an example of the file *RatingAgency.xml* already adapted to another rating system:

```
<?xml version="1.0" encoding="utf-8"?>
<RA>
<AGENCY NAME="http://www.classification.gov.au/
2007-ratings">
   <RATING>G</RATING>
   <RATING>PG</RATING>
   <RATING>M</RATING>
   <RATING>MA 15+</RATING>
   <RATING>R 18+</RATING>
   <RATING>X 18+</RATING>
</AGENCY>
</RA>
```

7.3 Keyboard Shortcuts

For a more easy and a faster control of the DCI Mastering feature there are various keyboard shortcuts available which are listed in the tables below:

Table 7-1: General keyboard shortcuts

Action	Shortcut
Open the digital cinema delivery tool	[Ctrl + D]
Open the finalize dialog	[Ctrl + F]

Table 7-2: Keyboard shortcuts for DC reels (i.e. when in DC reel mode)

Action (when in DC reel mode)	Shortcut
Set DC reel inpoint	[E], [I]
Set DC reel outpoint	[R], [O]
Delete DC reel inpoint	[D]
Delete DC reel outpoint	[F]
Delete DC reel in- and outpoint	[G]
Go to DC reel inpoint	[Q]
Go to DC reel outpoint	[W]

7.4 JPEG2000 Options

With the JPEG2000 options you can set its encoding parameters. They can be accessed via the **OPTIONS** button to the right of the **File format** field in the finalize dialog window (***Project » Finalize...***). The button will be available as soon as a JPEG2000 format is selected as the file format for video (e.g. `JP2`, `JPC` or `DC MXF`):

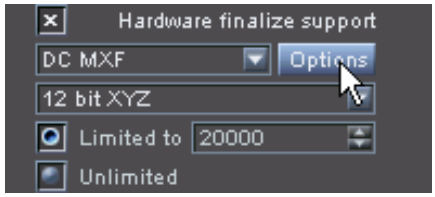


Figure 7-1: Accessing the JPEG2000 options

Then the following window will be displayed on the screen:

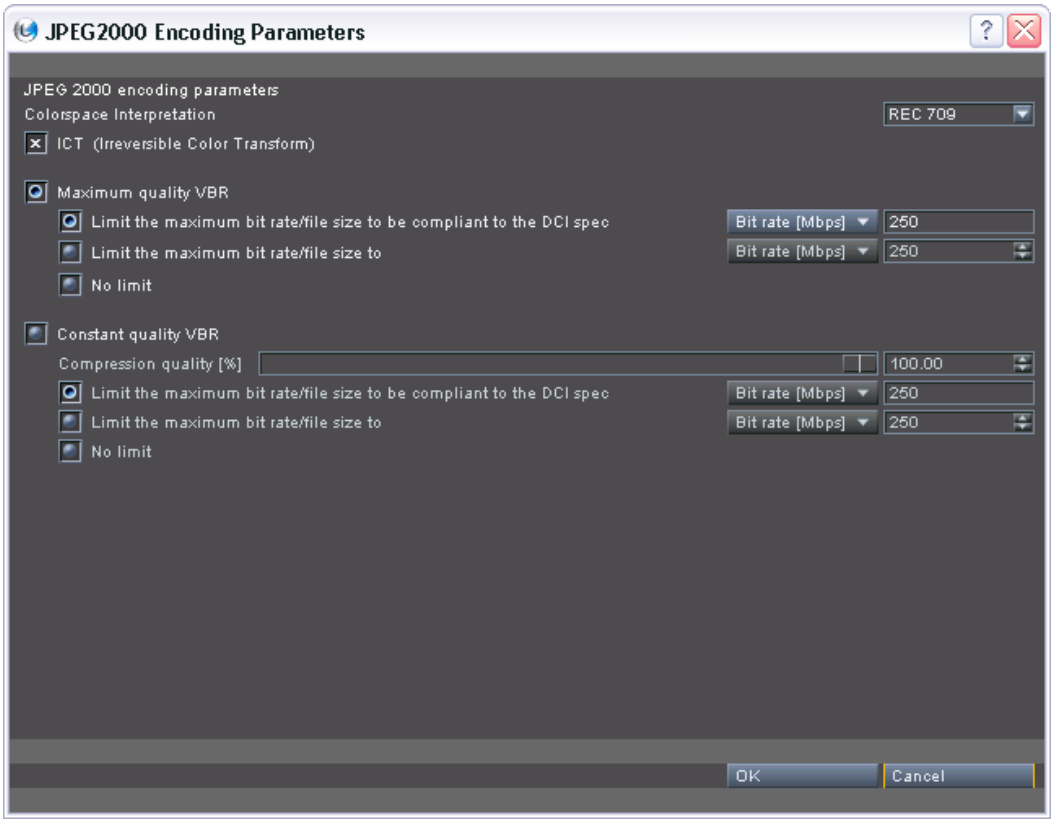


Figure 7-2: Configuring the JPEG2000 encoding

Further information about color space conversions can be found in section "Color Space Conversions" on page 7-2.

Further information about a JPEG2000 encoding can be found in section "JPEG2000" on page 2-3.

In detail the window to configure the JPEG2000 encoding provides the following settings items:

Colorspace Interpretation

This setting determines the color profile and interpretation of RGB video material:

- When converting from RGB to another color space (material in timeline is RGB, finalized output format is set to another color space), it sets the color profile of the source material, i.e. of the material in bin and timeline.
- When converting from another color space to RGB (material in timeline is in another color space, finalized output format is set to RGB), it sets the profile of the target material, i.e. of the material to be finalized and rendered.
- When converting from RGB to RGB (1:1 conversion) or when no RGB material is involved in the color space conversion, this setting has no effect.

When converting to X'Y'Z' the content of the timeline must be in a single color space only. With every other color space than X'Y'Z' selected as the target color space the timeline material is handled clip-wise, meaning each clip in the timeline is evaluated separately and converted with regard to its color space set in the bin properties.

The remaining settings items are identical to the ones displayed at the JPEG2000 configuration step. For further information about them see section "JPEG2000" on page 3-13.

7.5 Keys and Certificates Explained

There are various keys and certificates involved in the process of creating a DCP. This section tries to shed some light on them and the way they are used.

7.5.1 What's a Key

A key is a piece of information (normally a string) that determines the output of a cryptographic algorithm. The key is used during encryption by the cryptographic algorithm to transform a certain piece of information (e.g. plaintext) to ciphertext, i.e. encrypted information. Vice versa, during decryption the key is used by the algorithm to decode the ciphertext back to the original information.

There are two types of keys available:

symmetric	If the algorithm uses the same key during en- and decryption, it is known as a symmetric key algorithm.
asymmetric	Algorithms that require two different keys, one for encryption and one for decryption, are called asymmetric key algorithms. The concept behind them is that it is almost impossible to compute one key from the other. With this you can make one key public (the public key) while keeping the other in secret (the private key), thus providing others with the means, for example, to send encrypted pieces of information to the private key holder that only he can decode.

7.5.2 What's a Certificate

A certificate is a file that usually contains a key. Additionally it includes a digital signature to ensure the validity of the key/certificate. With this the purpose of a certificate is, on the one hand, to provide you with a key and, on the other, to confirm that this certificate and key belong to a certain identity (e.g. a person, institute or company).

Ideally the signature comes from a certificate authority (CA) charged with the task of checking identities before issuing certificates that refer to this identity. However, the most commonly used certificates are those that users make for themselves (self-signed certificates). Also common are certificates that users make for others so that these can certify validities on behalf of the user (certificate chain, see section "What's a Certificate Chain").

In the DCI Mastering a certificate normally contains a public key (`*.cer` or `*.pem` files). A private key is usually provided in a personal

information exchange file (*.pfx) which is typically encrypted and requires a password to be opened. This file will also contain the public key certificate (or more than one if a certificate chain is involved) for authentication as well. Thus, a PFX file contains besides the private key one or more public keys.

7.5.3 The Key Players of the DCI Mastering

Detailed in the following you can find the key pairs that are used during a DCI Mastering.

AES Key

The AES key is a symmetric key used to en- and decrypt the content of the DCP (track files). For each track file an individual AES key is generated. This key will be encrypted with the Encryption Key on CLIPSTER (see below) and written to the KDM file.

The AES key is generated randomly and automatically by CLIPSTER.

Encryption Key

The Encryption Key is an asymmetric key pair (RSA) used to encrypt and decrypt the AES key. Typically this key pair is generated by the manufacturer of the D-Cinema player and handed to the purchaser of the player:

- The **public key** of the Encryption Key is used to encrypt the AES key when it is written to the KDM. Usually it is embedded in a certificate file.
- The **private key** of the Encryption Key is stored on the D-Cinema server/player at the recipient's site. It is used to decrypt the AES key provided via the KDM.

The private key is stored at the recipient's site and will not be distributed. Thus it can be disregarded because it will not be available to you.

The public key should have been sent to you in a signed certificate to enable you to create a DCP for this player. It has to be set on CLIPSTER.

Signing Key

The Signing Key is an asymmetric key pair (RSA) used to sign and validate the files of a DCP (e.g. KDM or CPL). With it the creator of the DCP digitally signs the extra files, while the recipient will be able to verify that the DCP was distributed by the creator/distributor and not altered in the meantime.

Because DVS will not be the creator of a DCP (just the manufacturer of the DCI Mastering system), the user of CLIPSTER has to provide this

key. For a DCI Mastering DVS suggests that you use either your own Signing Key or one provided by your client.

The most appropriate way to receive a Signing Key is to order it from a certificate authority (CA). However, you can find included in the delivery of the DCI Mastering feature a tool that can be used to create a Signing Key (i.e. a self-signed certificate).

Do not take the step of creating your own Signing Key lightly. With it you should define and install a certificate hierarchy to enable others to validate your identity. You are the one responsible for the certificates issued within your certificate chain.

- The **private key** of the Signing Key is used to create a signature for the files of a DCP, i.e. it is used to encrypt hash values of the files.
- The **public key** of the Signing Key will be part of a certificate that will be attached to the extra files (if required, the certificate chain will be attached).

The private key has to be set on CLIPSTER. Normally, it is stored encrypted in a PFX file and will require a password to be opened.

Due to the fact that the public key is attached to the extra files via certificates, it will be distributed with them to the D-Cinema player automatically. There the exhibitor can extract it from the files and use it to verify the origin and validity of the DCP.

Self KDM Key

This key is not necessarily required. A DCP can be created without it, but afterwards it would be impossible to load it again with a DVS DCI Mastering system.

The key for a self KDM is in most respects identical to an Encryption Key. While the private key is stored securely in the hardware of the respective DVS DCI Mastering system, the complementary public key is provided via a certificate file. You can find this file either already stored in the installation directory of the DVS software on the respective system or on a separate CD-ROM. However, compared to the Encryption Key this key has to be set differently in the DVS software.

Further information about a self KDM and where it can be set in the DVS software can be found in chapter “Using the DCP and Self KDM” on page 4-1.

Summary

The following lists shortly the most important points about the different keys:

AES key	– Generated automatically by CLIPSTER
Encryption Key	– Certificate with public key must have been sent to you by the theater (typically the public key of a specific D-Cinema player) – Has to be set on CLIPSTER
Signing Key	– You have to provide this key pair – The private key has to be set on CLIPSTER – The public key will be attached to the extra files of the DCP and is thus delivered with the DCP automatically
Self KDM	– Similar to the Encryption Key – Public key file is available on CD-ROM or in the installation directory of the respective CLIPSTER – Requires a different setting than the Encryption Key in CLIPSTER See chapter “Using the DCP and Self KDM” on page 4-1.

7.5.4 The Keys Applied

The following shows in diagrams the keys as they are applied during a DCI Mastering on CLIPSTER and a play-out by the D-Cinema player.

Please note that the explanations of the keys at the recipient side are detailed for clarification only.

The Keys on CLIPSTER

This diagram shows the keys applied on a DVS DCI Mastering system:

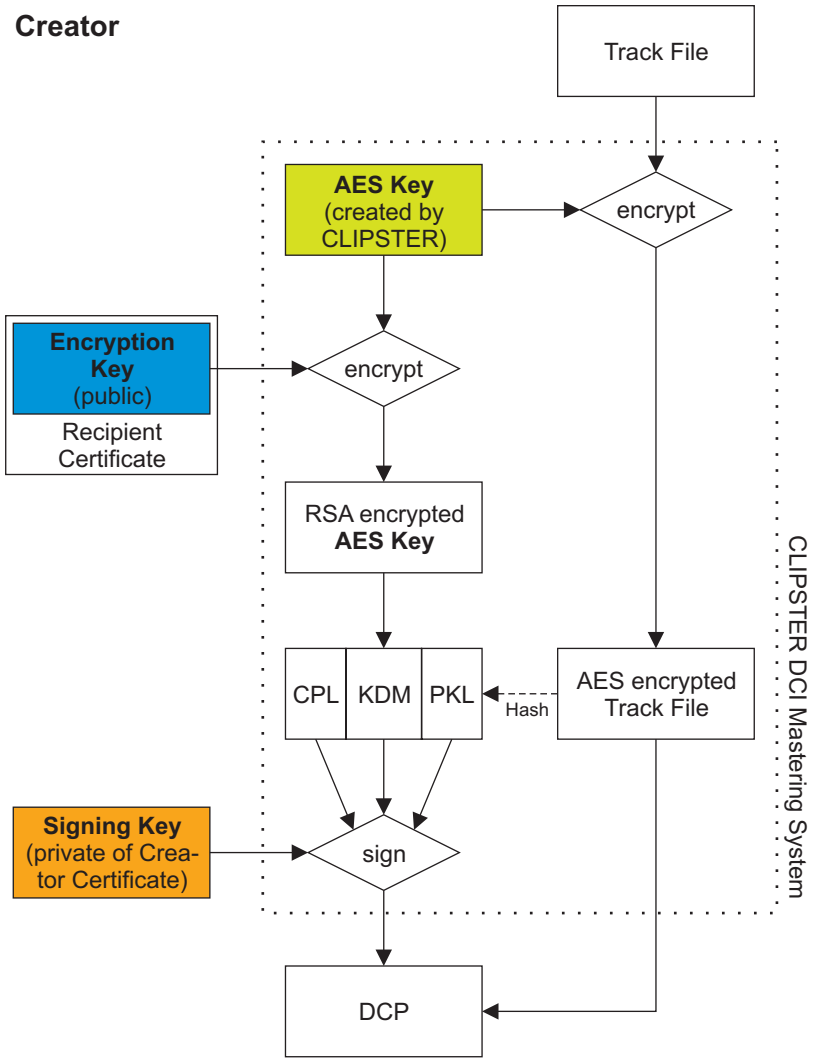


Figure 7-3: The keys and where they are used on the Creator side

The generated track file of the DCP is encrypted with an AES key that has been randomly generated by the DVS system. For each track file one AES key will be created and used. The AES keys are then encrypted with the public key of the Encryption Key. Afterwards the encrypted AES keys are written to the KDM file. Of each encrypted track file a hash value is created which is then written to the PKL file. Next, the completed CPL, KDM and PKL are signed with the Signing Key. The finished DCP can then be sent to the Recipient.

The Keys at the Recipient

This diagram shows the keys as they are applied at the Recipient's site:

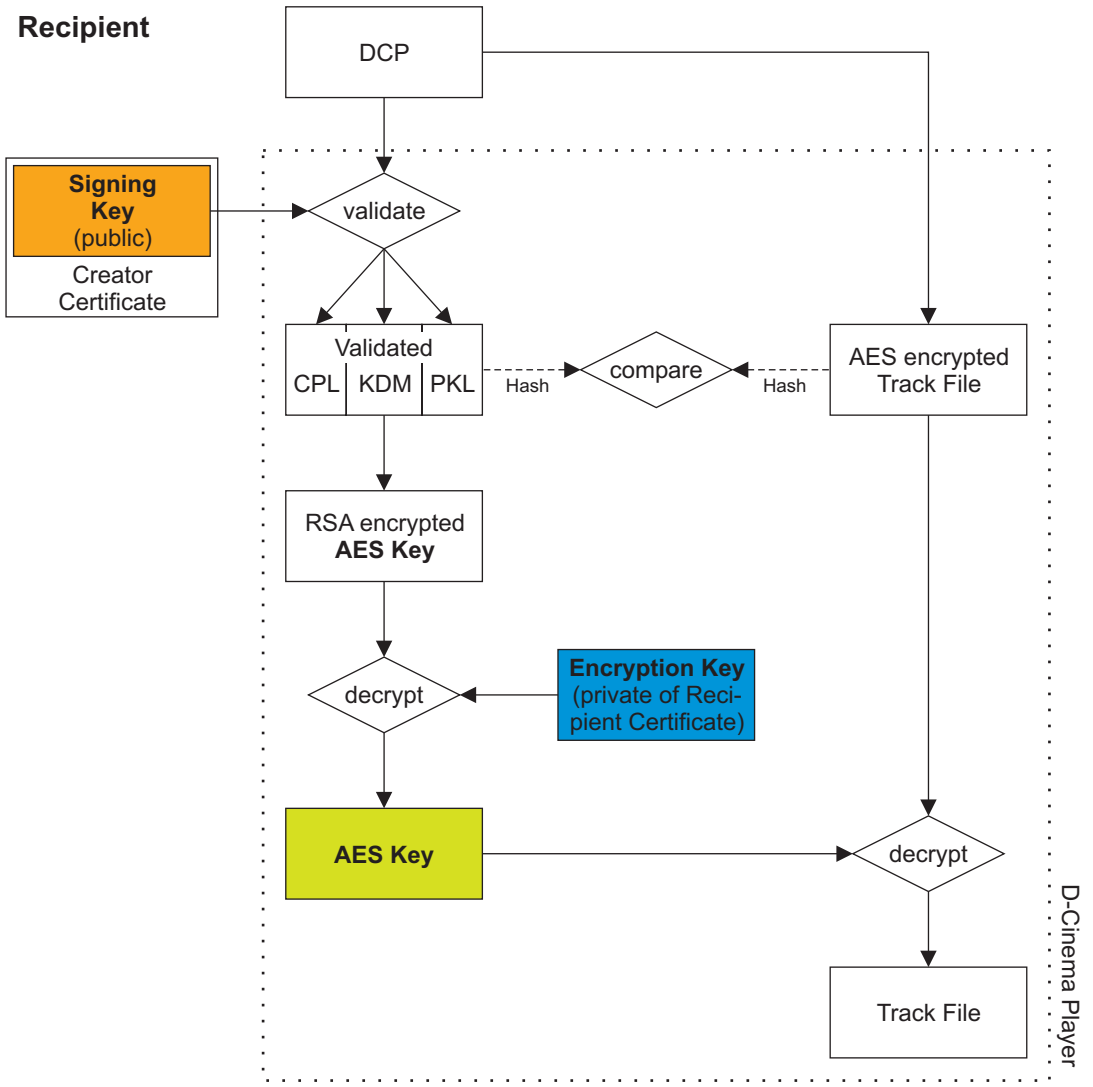


Figure 7-4: The keys and where they are used on the Recipient side

At the Recipient the received DCP has to be validated with the help of the public Signing Key that is attached to each extra file of the DCP (e.g. CPL, KDM or PKL). Whether the track files were received unmodified can be checked by comparing the hash values written in the validated (and thus unaltered) PKL file with hashs calculated from the received track files. The completely validated DCP can then be played out by decrypting the AES keys with the private key of the Encryption key. After this the AES keys will be used to decrypt the track files of the DCP.

7.5.5 What's a Certificate Chain

Certificates (see section "What's a Certificate") can be distributed in a chain, where the last certificate (the leaf certificate that cannot create

other certificates) certifies that it comes from another certificate (the intermediate certificate), this certifying that it comes from a further certificate (another intermediate), and so on until the last certificate in the chain is reached (the root certificate that confirms the validity of the whole chain as well as the identity of its issuer).

The whole structure of a certificate chain implies a hierarchy where the highest rank is held by the root and the lowest by the leafs.

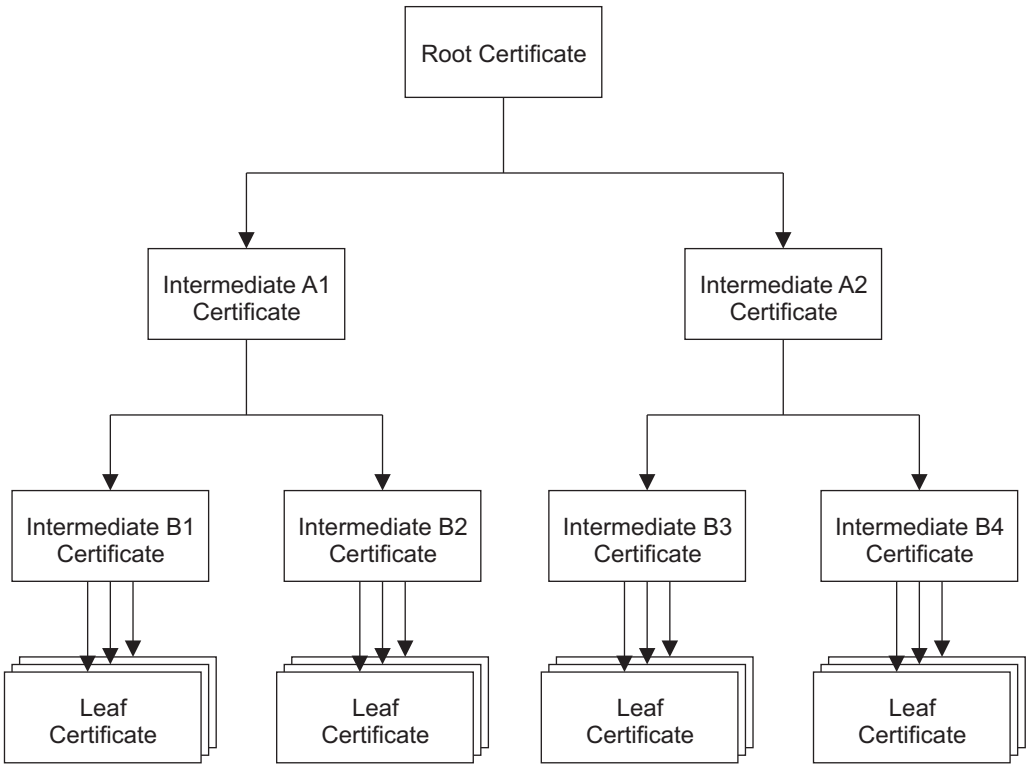


Figure 7-5: Certificate hierarchy

The root certificate is either a CA-issued certificate or a self-signed one, i.e. it is signed by its own private key. From this root certificate other certificates can be created (intermediates), that enable other users to digitally sign items in the name of the root via their private keys. Additionally, from intermediate certificates further certificates can be created (either other intermediates or leaf certificates). The last link in the chain is the leaf certificate that can only be used for signing, meaning other certificates cannot be created from a leaf.

All certificates in a certificate chain refer back to the identity that is bound to the root certificate and thus inherit the trustworthiness of the root.

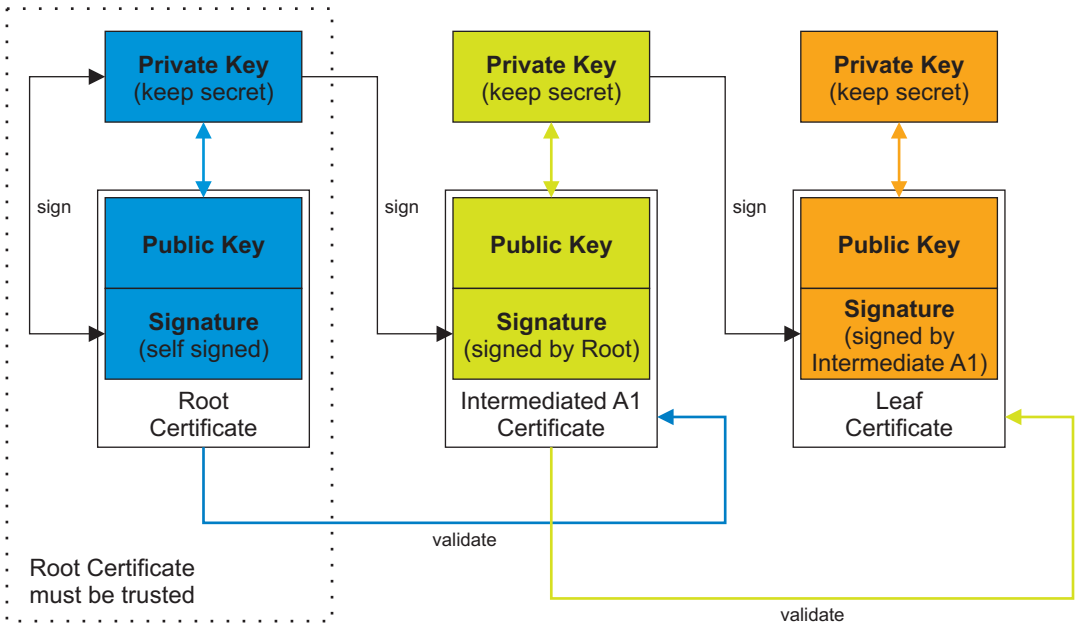


Figure 7-6: Certificate chain validation

In a public-key certificate no certificate chain is stored. So, in order to validate a leaf certificate at the end of a certificate chain, the complete chain up to the root certificate has to be available.

The maximum path depth from root to leaf that is allowed in a certificate hierarchy is a property of the root certificate. During the creation of the root it has to be set and it will be inherited correspondingly to the lower ranks. Within this path depth certificates can be created from root and intermediate certificates.

When setting up a certificate hierarchy take care that only trusted users receive certificates (i.e. the private key of these certificates). This applies especially to intermediate certificates that can be used to create other certificates.

7.5.6 Validating Certificates

As useful as the concept of certificates may seem, it fails when the validating certificate itself is a forgery. Thus the remaining question is, how can a receiver be sure about the origin of the signed files.

If the certificate was issued by a certificate authority, you can validate the certificate either via a public certificate repository, i.e. a database of issued certificates that is maintained by the CA, or by contacting the CA directly.

When dealing with a self-signed certificate, there is only one way: You should have received a duplicate of the respective public-key certificate

in a trusted communication and compare this with the certificate delivered with the signed files.

To validate a certificate chain the complete certificate chain has to be available to you. Nevertheless, although you need the certificate chain to verify the origin of a leaf or intermediate certificate, only its root certificate has to be verified via a secure communication because the chain leads to it (see also section "What's a Certificate Chain" on page 7-13).

7.5.7 The Keys and Certificates Delivered with CLIPSTER

In the delivery of the DCI Mastering feature you can find on the enclosed CD-ROM the following keys and certificates:

File:	**.cer*
Path:	*DVS\CLIPSTER\Key Store*
Explanation:	Public key for a self KDM for this CLIPSTER DCI Mastering system, i.e. the certificate/key to create a KDM for this DVS system to be able to decrypt a DCP there.

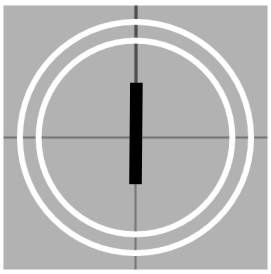
File:	*DvsClipsterDCIRoot.cer* *DvsClipsterDCIDvsAG.cer*
Path:	*DVS\CLIPSTER\Certificate Store\DVS* *DVS\CLIPSTER\Certificate Store\DVS*
Explanation:	The certificate chain of the public key for a self KDM (intermediate and root) for verification.

Use the following files for testing purposes only. They should not be used to create a DCP for distribution. For this you should use your own Signing Keys (see section "Signing Key" on page 7-9).

File:	*TestSigningCertificateLeaf.pfx*
Path:	*DVS\CLIPSTER\Signature Store\DVS Test*
Explanation:	*For testing only:* Private Signing Key for testing. With it you can sign the extra files of a DCP. Contains the complete chain of test certificates. Password: DVS

File:	*TestSigningCertificateLeaf.pem*
Path:	*DVS\CLIPSTER\Certificate Store\DVS Test*
Explanation:	*For testing only:* Test certificate. The public-key certificate of the private Signing Key for testing. With this file and the certificate chain the DCP can be validated.

File:	*TestSigningCertificateRoot.pem* *TestSigningCertificateIntermediate.pem*
Path:	*DVS\CLIPSTER\Certificate Store\DVS Test*
Explanation:	*For testing only:* Test certificates. The certificate chain for the public-key certificate of the private Signing Key for testing (intermediate and root) for verification.



Index

Numerics

3D 5-1
  anaglyph R/C stream 5-11, 5-16
  anaglyph R/G stream 5-12, 5-16
  capturing 5-16
  configuring tracks 5-8
  DCP 5-14
  dual stream 5-11, 5-13, 5-16
  editing 5-10
  empty timeline stretch 5-9
  error status 5-9
  finalizing 5-15
  HD-SDI 5-12, 5-17
  interleaved clip 5-2, 5-9, 5-16
  left eye/right eye 5-12
  merging tracks 5-7, 5-8
  output mode 5-11
  output ports 5-12
  preparing interleaved clip 5-4
  preparing separate clips 5-3
  resetting error status 5-9
  saturation (anagylph) 5-11, 5-16
  separate clips 5-2
  single stream 5-11
  single stream (combined) 5-12
  start of operation 5-8
  stereoscopic output mode . 5-8, 5-12
  synchronicity 5-9
  track number 5-9
  unmerging tracks 5-7, 5-8
3D LUT 3-10, 6-2, 7-2, 7-3

A

abbreviations 1-5
action in-/outpoints 2-14
  D-Cinema player 2-14
AES key 7-9, 7-11, 7-12
anaglyph R/C stream 5-11
  finalizing 5-16
anaglyph R/G stream 5-12
  finalizing 5-16
arrow (configuration steps) 3-3
aspect ratio 2-5
asset 3-19
  3D DCP 5-14
  supplemental DCP 4-10
Asset Map 3-22
audio channel mapping 2-5
audio format 2-5, 3-12, 6-3, 6-4, 6-10
audio retiming 3-12
audio routing 2-7, 2-8, 2-9, 2-15

B

bit rate 2-3, 3-14
blue line (DC reel) 2-13
button
  3D LUT 6-2
  3D Output ports 5-12
  Cancel 3-4
  Create 3-4, 3-20
  In/Out / DC reels . 2-10, 2-12, 2-13
  inpoint 2-12
  Key 6-9, 6-11, 6-12
  Load settings 3-4
  Name options ... 3-20, 6-2, 6-4, 6-6
  Next 3-4
  Options 7-6
  Other 5-16
  outpoint 2-12
  Playlist 6-8, 6-12
  Previous 3-4
  Render . 6-3, 6-5, 6-10, 6-11, 6-13
  Save settings 3-4
  Settings ... 2-7, 2-9, 5-3, 5-5, 5-12
  transfer 3-18

C

capturing 3D 5-16
certificate 3-18, 7-8
certificate authority (CA) 7-8, 7-10, 7-15
certificate chain 7-13
channel mapping 2-5
chapter overview 1-2
ciphertext 7-8
closing digital cinema delivery tool .. 3-4, 3-20
color profile 3-9, 7-2, 7-7
color space 3-9
  conversion 7-2
  DCDM 2-7, 6-2
  DSM 2-2, 2-7
  matrix 7-3
  of timeline 7-2
compression 2-3, 3-13, 7-6
configuration step 3-3, 3-5, 3-6
  KDM only 4-6
  supplemental DCP 4-8
Configuration Tool 2-17
configuring self KDM 2-18, 4-2
configuring tracks (3D) 5-8
constant quality VBR 3-14
conventions of user guide 1-4
conversion (color space) 7-2
CPL 1-5, 2-4
  creation 3-15, 6-8
  file 3-22
  load 4-3
  UUID 2-19
creating
  CPL 3-15, 6-8
  DCDM 3-6, 6-2
  DCP 3-6, 6-6
  further KDMs 4-6, 6-11
  JPEG2000 ..... 3-6, 6-4
  KDMs 3-17, 6-9
  MPEG Interop 6-7
  self KDM 3-18, 4-2
  supplemental DCP 3-7

D

data rate 2-3
DC KDM 6-11
DC MXF 6-6, 7-6
DC reel 2-10
  action in-/outpoints 2-14
  assets 3-19, 4-10, 5-14
  automatic setting 2-10, 4-9
  editing 2-13
  in-/outpoints 2-12, 2-15
  name 2-11, 2-12, 2-15
  remove 2-16
  subtitle 3-16
  supplemental DCP 4-9
  tab 'DC reels' 2-14
DC reel mode 2-10, 2-13
DCDM 1-5, 2-3
  color space 2-7, 6-2
  color space conversion 7-2
  creation 3-6, 6-2
  generated files 3-21
  preparation 2-7
DCI 1-1, 1-5
DCI Mastering 1-1
  start 2-20
D-Cinema player 3-18
  action in-/outpoints 2-14
  forensic marking 3-18
  KDM 3-17, 6-9
  key 7-9
  subtitles 3-16
DCP 1-5, 2-4
  3D 5-1, 5-14
  audio format 2-5
  creation 3-6, 3-7, 6-6
  encrypted 3-7, 3-18, 6-9
  extra files 2-4
  formats 2-4
  generated files 3-21
  load 4-3
  localization 4-7, 6-12
  master 3-6, 3-7, 4-7, 6-12
  name 3-20
  unencrypted 3-6, 3-18, 6-9
  versions 4-7, 6-12
  video format 2-5
DCP phases 2-2
DCP standards 2-6
delivery creation 3-19
  3D 5-14
  supplemental DCP 4-10
delivery format 3-11
delivery type 3-5
digital cinema delivery tool 2-20, 3-1
  3D 5-14
  close 3-4, 3-20
  configuration steps 3-3, 3-5, 3-6
  load settings 3-4
  overview 3-3

save settings 3-4
start 3-2
DLP P3 3-10
DLP P7 3-10
DSM 1-5, 2-2
color space 2-2, 2-7
preparation 2-7
dual stream 5-11
finalizing 5-16
output 5-13
Duration 2-14

E

editing 3D stereo tracks 5-10
editing DC reels 2-13
empty timeline stretch (3D) 5-9
encrypted DCP 3-7, 3-18
finalizing 6-9
Encryption Key 7-9, 7-11, 7-12
setting 3-18
EntryPoint 2-14
error status (3D) 5-9
reset 5-9
exchange format 2-3
extra files of a DCP 2-4

F

file size 2-3, 3-14
finalizing 6-1
3D 5-15
DCDM 6-2
DCP 6-6
encrypted DCP 6-9
interleaved clip 5-16
JPEG2000 6-4
separate clips 5-16
unencrypted DCP 6-9
font 3-16, 3-21
forensic marking 3-18
format 2-4
frame rate 2-2, 2-3, 2-7

G

general settings 2-17

H

hardware finalize support . 6-2, 6-4, 6-7
HD-SDI 5-12, 5-17
hierarchy 7-14

I

ICT 3-14
input format 5-16
interleaved clip (3D) 5-2, 5-9
finalizing 5-16
intermediate certificate 7-14
intermediate step 2-2

J

JP2 ..... 6-4, 7-6
JPC 7-6
JPEG Interop 2-6, 2-19
JPEG2000 ..... 2-3, 3-13, 7-6
creation 3-6, 6-4
generated files 3-21
preparation 2-9

K

KDM 1-5, 2-4
creating further KDMs 4-6, 6-11
creation 3-17, 6-9
file 3-22
KDM only 3-7, 4-6
configuration steps 4-6
key 7-8

L

leaf certificate 7-14
left eye/right eye (3D) 5-12
letterboxing 2-5
load settings 3-4
loading
of CPL 4-3
of DCP 4-3
of self KDM 4-4, 4-5
localization of a DCP 4-7, 6-12
loudspeaker 2-5

M

manual creation 2-20, 6-1
mapping 2-5
master DCP 3-6, 3-7, 4-7, 6-12
master project 2-2

matrix 7-3
maximum quality VBR 3-14
merging tracks (3D) 5-7, 5-8
monitor 5-10
MPEG Interop 2-6, 2-19
    create 6-7
MPEG2 VES 6-7
multi-channel file 3-12, 6-3, 6-4
MXF 2-4, 3-22
    reels 2-10
MXF Interop 2-6

N

name of DC reel 2-11, 2-12, 2-15
name of DCP 3-20
next step 3-4
notes 1-5

O

option 1-5
orange line (DC reel) 2-14
output mode (3D) 5-11
outputs 5-10
    HD-SDI 5-12
overview
    of chapters 1-2
    of DCP phases 2-2
    of digital cinema delivery tool 3-3

P

path depth 7-15
PFX file 2-18, 7-9, 7-10
phases of a DCP 2-2
pillarboxing 2-5
PKL 1-5, 2-4
    file 3-22
plaintext 7-8
post compression rate control 3-14
preparing
    DCDM 2-7
    DSM 2-7
    interleaved clip (3D) 5-4
    JPEG2000 2-9
    separate clips (3D) 5-3
previous step 3-4
profile 3-9, 7-2, 7-7

R

rating 3-15, 7-4
rating agency 3-15, 7-4
REC 709 3-10
reel 2-4
    see also DC reel
    MXF 2-10
removing DC reel 2-16
resetting error status (3D) 5-9
retiming (audio) 3-12
RGB 3-9
root certificate 7-14
routing 2-7, 2-8, 2-9, 2-15

S

saturation 5-11, 5-16
save settings 3-4
self KDM 4-1
    configuration 2-18, 4-2
    creation 3-18, 4-2
    file 3-22, 4-2
    key 7-10, 7-11
    key setting 2-19
    load 4-4, 4-5
    loading DCP 4-3
    public key 7-16
    validity 4-1
    verification 7-16
separate clips 5-2
    finalizing 5-16
setting Encryption Key 3-18
setting Signing Key 2-18
shortcuts 7-5
signature 3-22, 7-8, 7-10
signing extra files 2-18, 7-9, 7-12
Signing Key 7-9, 7-11, 7-12
    setting 2-18
single stream 5-11
    combined 5-12
single track 5-7
SMPTE 1-1, 1-5
SMPTE Phase 1 .....2-6, 2-19
source data 2-7, 7-2
source type 3-9
standards 2-6
starting
    DCI Mastering 2-20
    digital cinema delivery tool 3-2
    of operation (3D) 5-8
stereoscopic 3D track 5-7

stereoscopic output mode 5-8, 5-12
stereoscopy
see 3D
storage location 3-20, 6-2, 6-4, 6-6
supplemental DCP 4-10
subtitle 3-16, 3-21
supplemental DCP 4-8, 4-9
supplemental DCP 4-7
assets 4-10
configuration steps 4-8
creation 3-7
DC reels 4-9
delivery creation 4-10
storage location 4-10
subtitles 4-8, 4-9
synchronicity (3D) 5-9

T

tab 'DC reels' 2-14
target group 1-3
TIFF 2-3, 2-7, 3-6, 6-2
track mode item 5-7
track number (3D) 5-9
track properties window 5-8
trusted communication 7-16
typographical conventions 1-4

U

unencrypted DCP 3-6, 3-18
finalizing 6-9
unmerging tracks (3D) 5-7, 5-8
UUID 2-19

V

validation 7-9, 7-13, 7-15
validity 7-8
of DCP 3-17
of self KDM 4-1
VBR 2-3, 3-14
verification 2-18, 3-22, 7-9, 7-16
versions of a DCP 4-7, 6-12
video format .. 2-5, 3-11, 6-3, 6-4, 6-7
stereo (3D) 5-16
video overlay 5-10
virtual DC reel 4-9
Volume Index 3-22

W

watermarking 3-18
WAV 2-5, 3-12, 6-3, 6-4

X

X'Y'Z' 2-3, 2-7, 3-9, 3-10, 6-2, 7-2
XYZ projector 4-4

Y

YCxCz 2-8, 3-10
YUV matrix 2-8, 3-10